Yukon Electricity Conservation and Demand Management Potential Review (CPR 2011)

Commercial Sector – Final Report

9 January 2012

Submitted to:
Yukon Energy, Yukon Electrical Company,
Government of Yukon

Submitted by:
ICF Marbek
300-222 Somerset Street West
Ottawa,Ontario K2P 2G3

Tel: +1 613 523-0784
Fax: +1 613 523-0717
info@marbek.ca
www.marbek.ca

[This page intentionally left blank.]

Executive Summary

Background and Objectives

Yukon residents rely on electricity not only to live meaningful, healthy lives but also to support and strengthen the economy. Given the concerns over environmental implications including climate change, and the limited generating capacity in Yukon, there is growing interest not only in how electricity is generated, transmitted and distributed but also how efficiently it is used at the customer's end. In Yukon, as well as in a growing number of North American jurisdictions, how electricity is generated and used is being closely analyzed to find innovative ways of meeting individual and corporate energy service needs while minimizing pollution and the creation of greenhouse gases.

Experience throughout many North American jurisdictions has demonstrated that energy efficiency, conservation and customer-supplied alternative energies all have a significant potential to reduce energy consumption, energy costs and emissions. The 2009 *Energy Strategy for the Yukon* also recognizes this potential and notes the following efficiency and conservation priorities:

- Avoid the cost and environmental impact of building new generation
- Increase energy efficiency in Yukon by 20% by 2020
- Reduce energy consumption in Yukon buildings
- Reduce energy consumption for transportation in Yukon
- Promote the use of energy-efficient products by providing incentives for products that meet energy performance standards
- Improve energy efficiency for Government of Yukon operations.

Efficient use of electricity through conservation, peak demand control and alternative energy sources can assist greatly in the path forward for the electrical supply industry. This conservation potential review study, referenced as CPR 2011, will provide a resource for Yukon Energy Corporation (YEC), Yukon Electrical Company Limited (YECL), and the Government of Yukon to develop a comprehensive vision of the territory's future energy service needs.

More specifically, the objective for this study is to provide:

"...a necessary reference point to determine the potential for (electricity) demand-side management (DSM) in the Yukon."[1]

Scope

The scope of this study is summarized below:

- Sector Coverage: This study addresses two sectors: residential households (Residential sector), and commercial and institutional buildings (Commercial sector).[2]

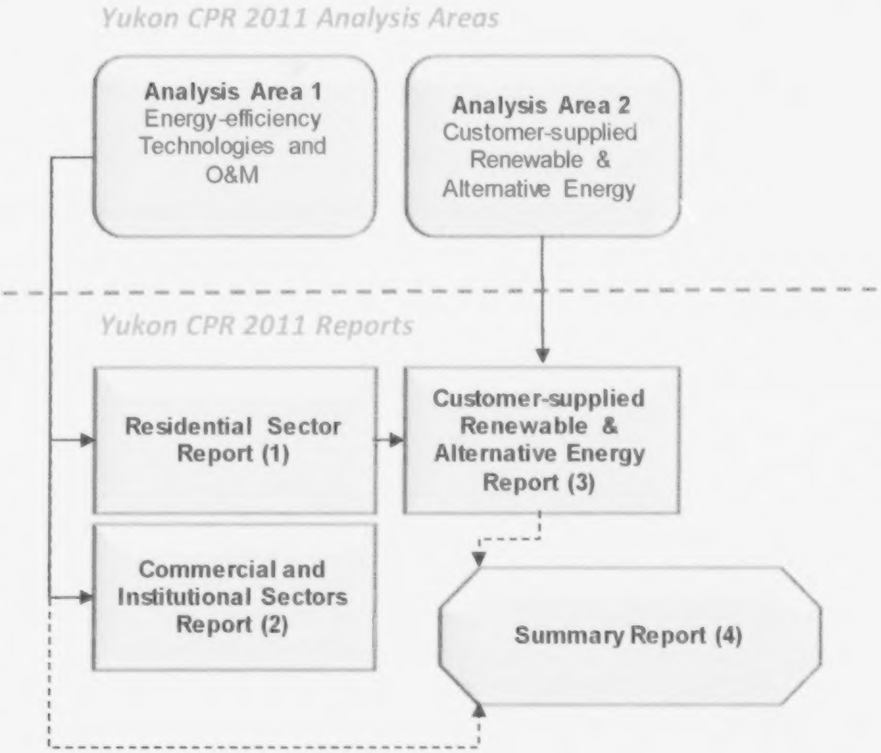
---

[1] Yukon Energy Corporation Request For Proposals #2010-045, "Consulting Services for Electricity Conservation and Demand Management Potential Study," 2011.

- Geographical Coverage: The study addresses all regions of Yukon that are served by either YEC or YECL. Customers served by both the hydro-electric grid and the stand-alone diesel grids are included. Note that the hydro-electric grid is remote and dependent on trucked fuel to meet demand above the existing hydro/ wind capacity, while the stand-alone diesel grids rely on fuel that is trucked or flown in at all times.
- Study Period: This study covers a 20-year period. The Base Year is the calendar year 2010, with milestone periods at five-year increments: 2015, 2020, 2025 and 2030. The Base Year of 2010 was selected to enable this study's results to be aligned with the most recent Yukon load forecast.
- Technologies: This study addresses a comprehensive range of demand-side management (DSM) measures. This includes all electrical efficiency technologies or measures that are expected to be commercially viable by the year 2015, as well as peak load reduction technologies and customer-side renewable energies.

CPR 2011 has been organized into four analysis areas and the results are presented in four reports, as show in Exhibit ES 1, below.

Exhibit ES 1 Overview of CPR 2010 Organization – Analysis Areas and Reports


Yukon CPR 2011 Analysis Areas
Analysis Area 1 Energy-efficiency Technologies and O&M
Analysis Area 2 Customer-supplied Renewable & Alternative Energy
Yukon CPR 2011 Reports
Residential Sector Report (1)
Customer-supplied Renewable & Alternative Energy Report (3)
Commercial and Institutional Sectors Report (2)
Summary Report (4)

This report presents the results of Analysis Area 1: Energy-efficiency Technologies and O&M, for Commercial sector customers (Report 2 in Exhibit ES 1 above). This report addresses all

---

[2] Yukon's Industrial sector consists primarily of a small number of operating mines. Efficiency opportunities within these sites will be addressed outside of this study.

commercially available electric energy-efficiency and peak load reduction measures that are applicable to Yukon's Commercial sector.

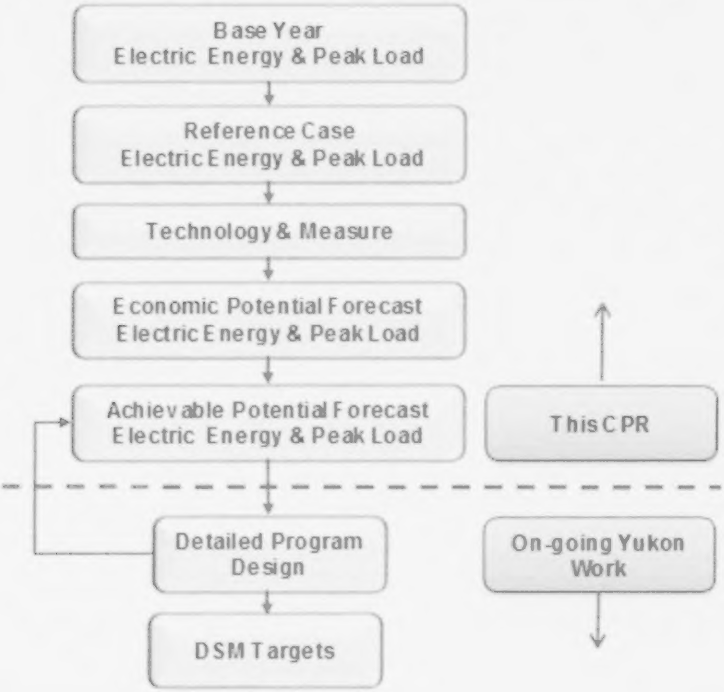
Approach

The detailed end-use analysis of electrical efficiency opportunities in the Commercial sector employed two linked modelling platforms: CEEAM (Commercial Electricity and Emissions Analysis Model), an in-house simulation model developed in conjunction with Natural Resources Canada for modelling electricity use in commercial/institutional building stock, and CSEEM (Commercial Sector Energy End-use Model), an ICF Marbek in-house spreadsheet-based macro model. Peak load savings were modelled using Lopes Consulting Services, Inc.'s Cross-Sector Load Shape Library Model (LOADLIB).

The major steps involved in the analysis are shown in Exhibit ES 2 and are discussed in greater detail in Section 2 of this report. As illustrated in Exhibit ES 2, the results of CPR 2011, and in particular the estimation of Achievable Potential,[3] support on-going demand-side management work; however, it should be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific DSM targets or with program design.

Overall Commercial Study Findings

Exhibit ES 2 CPR 2011: Main Analytic Steps


Base Year
Electric Energy & Peak Load
Reference Case
Electric Energy & Peak Load
Technology & Measure
Economic Potential Forecast
Electric Energy & Peak Load
Achievable Potential Forecast
Electric Energy & Peak Load
This CPR
Detailed Program Design
On-going Yukon Work
DSM Targets

---

[3] The proportion of savings identified that could realistically be achieved within the study period.

As in any study of this type, the results presented in this report are based on a number of important assumptions. Assumptions such as those related to the current penetration of efficient technologies and the rate of future growth in the building stock are particularly influential. Wherever possible, the assumptions used in this study are consistent with those used by the Yukon utilities and government. However, the reader is referred to a number of caveats throughout the main text of the report. Given these assumptions, the CPR 2011 findings confirm the existence of significant potential cost-effective opportunities for electric energy[4] and peak load savings in Yukon's Commercial sector.

Electric energy savings from electrical efficiency improvements would provide between 44,000 and 60,000 MWh/yr. of electricity savings by 2030 in, respectively, the lower and upper Achievable scenarios. The most significant Achievable Savings opportunities addressed indoor lighting and space heating. Significant savings were also found in refrigeration equipment, computer equipment and HVAC fan & pumps.

The electric energy savings noted above would provide peak load savings of approximately 8.5 to 11.9 MW during Yukon's annual system peak hour by 2030 in, respectively, the lower and upper Achievable scenarios.

Summary of Commercial Sector Electric Energy Savings

A summary of the levels of annual electricity consumption contained in each of the forecasts addressed by CPR 2011 is presented in Exhibit ES 3 and Exhibit ES 4, by milestone year.

Exhibit ES 3 Electricity Savings by Milestone Year, Three Scenarios (MWh/yr.)

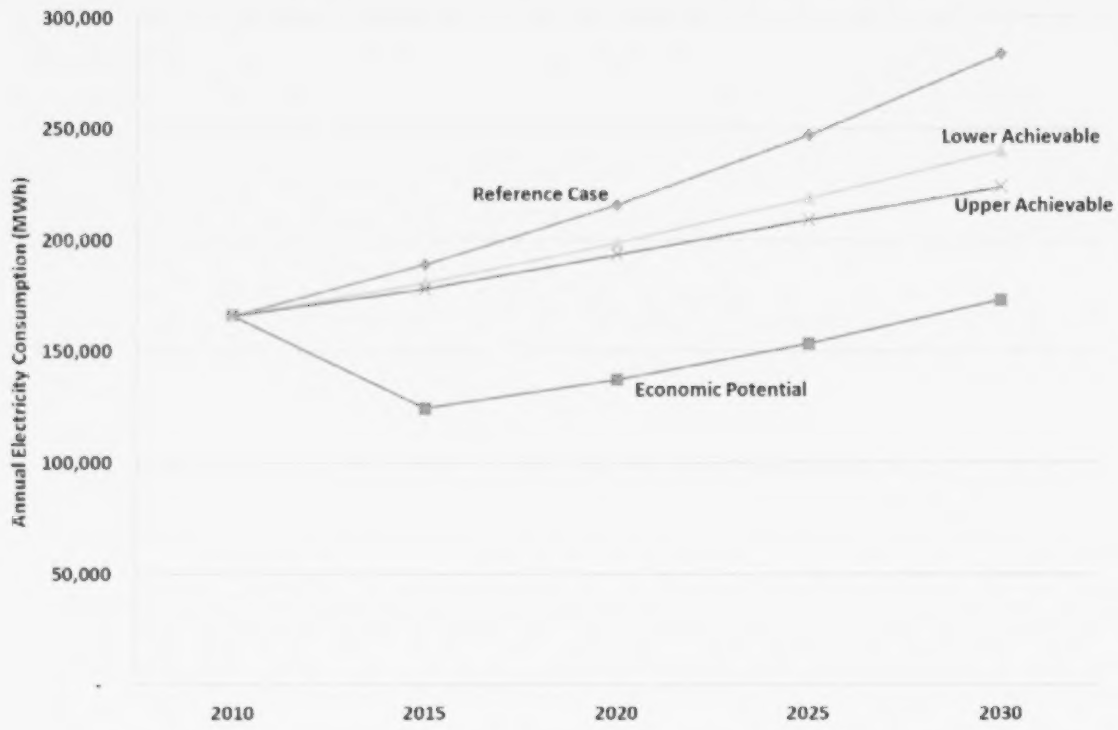
Year	Economic Potential Scenario		Upper Achievable Potential Scenario		Lower Achievable Potential Scenario	
	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case
2015	64,612	34%	11,122	6%	8,269	4%
2020	78,419	36%	22,377	10%	17,208	8%
2025	93,542	38%	38,017	15%	28,206	11%
2030	110,406	39%	59,819	21%	43,617	15%

*Results are measured at the customer's point-of-use and do not include line losses.

---

[4] The term "electric energy" is used in this report to distinguish electricity consumption (in units of kWh or MWh) from electricity demand during a specific period (in units of MW).

Exhibit ES 4 Annual Electricity Consumption—Energy-efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Commercial Sector, (MWh/yr.)



Base Year Electricity Use

In the Base Year of 2010, Yukon's Commercial sector consumed approximately 166,000 MWh. Exhibit ES 5 shows that lighting is the largest Commercial sector end use in 2010, accounting for approximately 37% of total Commercial sector electricity use. Indoor lighting, which consists of general, architectural and high-bay lighting, accounts for approximately 34% while outdoor lighting accounts for remaining 3% of lighting use. HVAC end uses (space heating, space cooling and HVAC fans & pumps) account for 22% of Base Year electricity use. Cooking equipment, domestic water heating and a number of smaller end uses account for the remaining Commercial sector electricity use. Non-building loads are treated as both an end use and sub sector in this analysis. These loads account for 13% of Commercial sector end use electricity consumption. The same exhibit also presents the Reference Case consumption by end use in 2030, at the end of the study period, for comparison.

Exhibit ES 6 shows the distribution of Base Year electricity consumption by sub sector. As illustrated, Other General Service Buildings account for the largest share of electricity use within the building sub sectors (18%), followed by Office (14%). and Education, Warehouse/Wholesale & Non-food Retail at 9% each. Non-buildings account for 13% of Base Year Commercial sector electricity use. The same exhibit also presents the Reference Case consumption by sub sector in 2030, at the end of the study period, for comparison.

Reference Case – Electric Energy

In the absence of new DSM initiatives, CPR 2011 estimates that electricity consumption in the Commercial sector will grow from 166,000 MWh/yr. in 2010 to about 284,000 MWh/yr. by 2030. This represents an overall growth of about 71% in the period and is higher than the forecast set out in YEC's 20-Year Resource Plan – 2011. This is largely because projections of construction of electrically heated commercial buildings have been revised since the publication of that forecast.

Exhibit ES 5 shows that expected change in energy consumption by 2030 in the absence of any new DSM initiatives. Space heating is expected to rise to approximately 21% of commercial electricity consumption, while general lighting is expected to fall to 14%. Overall, indoor lighting makes up 28% of commercial electricity consumption in 2030, while HVAC end uses account for 30%.

Exhibit ES 6 shows the expected change in the distribution of electricity consumption by sub sector in 2030 in the absence of any new DSM initiatives. As illustrated, the distribution of electricity consumption by sub sector is expected to remain relatively consistent over time, with Diesel Grid General Service Buildings and Non-buildings growing at a slower pace than the remaining sub sectors.

Exhibit ES 5 Base Year and Reference Case Electricity Use by End Use, Commercial Sector

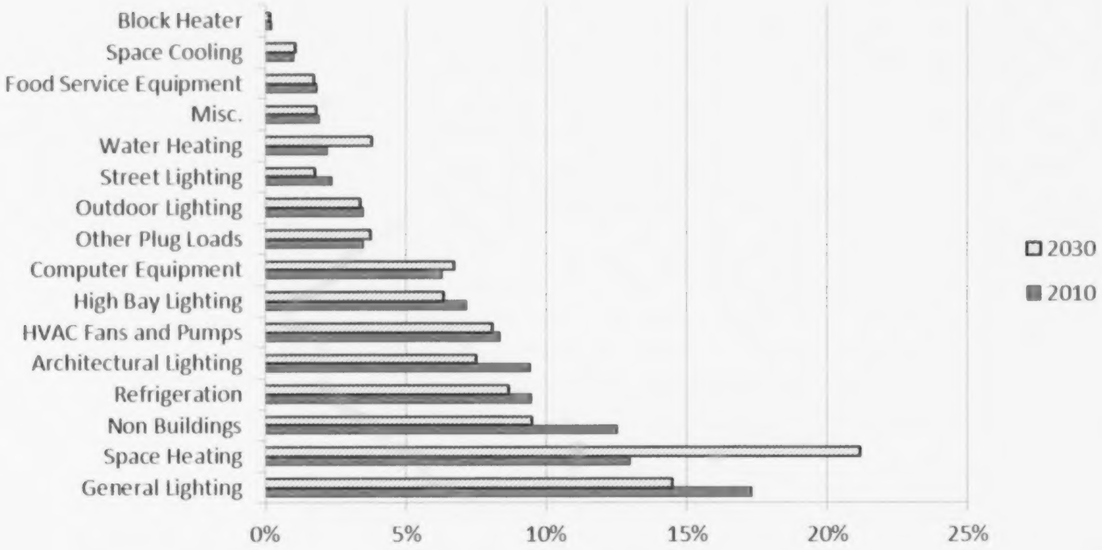
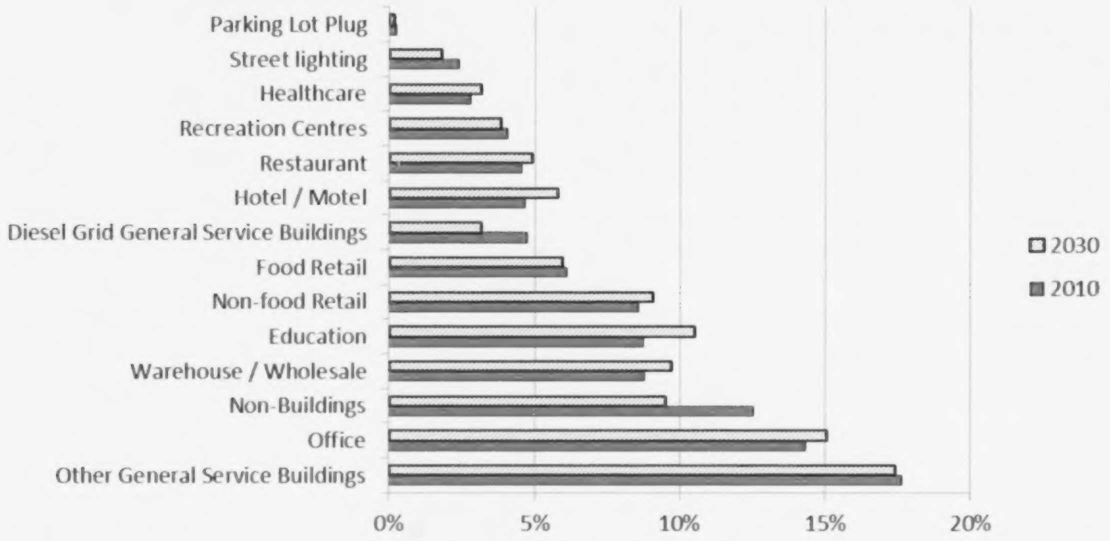


Exhibit ES 6 Base Year and Reference Case Electricity Use by Sub Sector, Commercial Sector



Economic Potential Forecast – Electric Energy

Under the conditions of the Economic Potential Forecast,[5] the study estimated that electricity consumption in the Commercial sector would grow to about 173,000 MWh/yr. by 2030. Annual savings relative to the Reference Case are 110,000 MWh/yr., or about 39%. The Economic Potential annual savings in the intermediate milestone years are 65,000 MWh/yr. in 2015, 78,000 MWh/yr. in 2020 and 94,000 MWh/yr. in 2025.

Achievable Potential – Electric Energy

The Achievable Potential is the proportion of the economic electric energy savings (as noted above) that could realistically be achieved within the study period. In the Commercial sector, the Achievable Potential for electric energy savings through technology adoption was estimated to be 44,000 MWh/yr. and 60,000 MWh/yr. by 2030 in, respectively, the lower and upper scenarios.

Consistent with the results in the Economic Potential Forecast, the most significant Achievable savings opportunities were in the actions that addressed indoor lighting and space heating.

Summary of Peak Load Savings

Based on discussions with utility personnel, the following three peak period definitions were selected for inclusion in this study:

- Peak Period 1: Annual System Peak Hour – For YECL, this has traditionally been the hour ending at 6 pm on a day in December; it is highly correlated with the coldest day of the year when occurring in December, although it has sometimes occurred in January.

---

[5] The level of electricity consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective against future avoided electricity costs.

- Peak Period 2: Annual Weekday System Peak Period – The 4-8 pm period on the coldest four days of the year when occurring in December or January (total 16 hours).

- Peak Period 3: Annual Weekday System Morning Peak Period – The 7-9 am period on the 10 coldest days of the year when occurring in December or January (total 20 hours). This also corresponds to the system peak for some of the diesel grids.

Exhibit ES 7 provides a summary of the peak load savings from the electric energy savings, for Peak Period 1. Details for the other two peak periods are provided in the main body of the report. In each case, the reductions are an average value over the peak period and are defined relative to the Reference Case.

Exhibit ES 7 Commercial Peak Load Reductions for Peak Period 1, from Electric Energy Savings Measures, Reference Case, Economic and Achievable Scenarios (MW)

Milestone Year	Period 1: Peak Hour				
	Base Year	Reference Case	Peak Load Reduction from Electric Energy Savings		
			Economic	Upper Achievable	Lower Achievable
2010	29.9	29.9			
2015		34.6	12.8 (37%)	1.9 (6%)	1.4 (4%)
2020		39.9	15.6 (39%)	4.1 (10%)	3.1 (8%)
2025		46.1	18.7 (41%)	7.3 (16%)	5.3 (11%)
2030		53.4	22.2 (42%)	11.9 (22%)	8.5 (16%)

Highlights of the peak load savings shown in Exhibit ES 7 are presented below:

- In the Base Year 2010, the peak load for Yukon's total Commercial sector was approximately 29.9 MW for Peak Period 1, the system peak hour.

- The study estimates that the Commercial sector peak load in Peak Period 1 will grow to 53 MW by 2030, an increase of about 78%.

- Electric energy savings would provide peak load savings of approximately 8.5 to 11.9 MW during Yukon's annual system peak hour (Peak Period 1) by 2030 in the lower and upper Achievable scenarios respectively.

Table of Contents

Executive Summary i

1 Introduction 1
- 1.1 Background and Objectives 1
- 1.2 Study Scope 2
- 1.3 Study Organization 2
- 1.4 Report Organization 3
- 1.5 Results Presentation 4

2 Study Methodology 6
- 2.1 Definition of Terms 6
- 2.2 Major Analytic Steps 8
- 2.3 Analytical Models 11

3 Base Year (2010) Electric Energy Use 13
- 3.1 Introduction 13
- 3.2 Commercial Sector Segmentation 13
- 3.3 End Uses 14
- 3.4 End-use Saturation and Fuel Share Data 15
- 3.5 Detailed Building and Equipment Specifications 16
- 3.6 Floor Area Calculations 19
- 3.7 Commercial Base Year Electricity Use 20

4 Base Year (2010) Electric Peak Load 24
- 4.1 Introduction 24
- 4.2 Peak Period Definitions 24
- 4.3 Methodology 24
- 4.4 Summary of Results 26

5 Reference Case Electric Energy Forecast 28
- 5.1 Introduction 28
- 5.2 Methodology 28
- 5.3 New Commercial Buildings 28
- 5.4 “Natural Changes” to Electricity Use Intensity 30
- 5.5 Commercial Floor Space 31
- 5.6 Summary of Model Results 32
- 5.7 Selected Highlights 37

6 Reference Case Electric Peak Load Forecast 38
- 6.1 Introduction 38
- 6.2 Methodology 38
- 6.3 Summary of Results 38

7 Technology Assessment: Energy-efficiency Measures 43
- 7.1 Introduction 43
- 7.2 Methodology 43
- 7.3 Energy-efficiency Technology Assessment 46
- 7.4 Energy-efficiency Supply Curves 49

8 Economic Potential: Electric Energy Forecast 52
- 8.1 Introduction 52
- 8.2 Avoided Cost Used For Screening 52
- 8.3 Major Modelling Tasks 53

8.4 Technologies Included in Economic Potential Forecast 53
8.5 Summary of Electric Energy Savings 55
8.6 Interpretation of Results 61
8.7 Energy-efficiency Supply Curves 62
8.8 Summary of Electric Peak Load Reductions 65

9 Technology Assessment: Peak Load Measures 69
9.1 Introduction 69
9.2 Methodology 69
9.3 Electric Peak Supply Curves 73

10 Achievable Potential: Electric Energy Forecast 77
10.1 Introduction 77
10.2 Description of Achievable Potential 77
10.3 Approach to the Estimation of Achievable Potential 79
10.4 Achievable Workshop Results 84
10.5 Summary of Potential Electric Energy Savings 90
10.6 Summary of Electric Peak Load Reductions 101

11 References 107

12 Glossary 109

Appendix A Background-Section 3: Base Year Electricity Use A-1

Appendix B Background-Section 4: Base Year Peak Load B-1

Appendix C Background-Section 5: Reference Case Electricity Use C-1

Appendix D Background-Section 6: Reference Case Peak Load D-1

Appendix E Background-Section 7: Technology Assessment: Energy-efficiency Measures E-1

Appendix F Background-Section 8: Economic Potential: Electric Energy Forecast F-1

Appendix G Background-Section 9: Technology Assessment: Peak Load Measures G-1

Appendix H Background-Section 10: Achievable Potential: Electric Energy Forecast H-1

List of Exhibits

Exhibit ES 2 CPR 2011: Main Analytic Steps iii
Exhibit 1 Overview of CPR 2011 Organization – Analysis Areas and Reports 3
Exhibit 2 Major Analytic Steps 8
Exhibit 3 Commercial Sub Sectors 14
Exhibit 4 Commercial Sector End Uses 15
Exhibit 5 Electric Fuel Share by Sub Sector (%) 16
Exhibit 6 Space Cooling Saturation by Sub Sector (%) 16
Exhibit 7 Sample Building Profile Summary – Existing Office 18
Exhibit 8 Base Year Floor Area by Sub Sector – Hydro Grid 19
Exhibit 9 Base Year Floor Area – Diesel Grids 19
Exhibit 10 Base Year Annual Electricity Consumption by Sub Sector and End Use (MWh/yr.) .. 21
Exhibit 11 Distribution of Electricity Consumption by Sub Sector, Base Year (2010) 22
Exhibit 12 Distribution of Electricity Consumption by End Use, Base Year (2010) 22
Exhibit 13 Distribution of Electricity Consumption by Supply Type and Government versus Non-government, Base Year (2010) 23
Exhibit 14 Overview of Peak Load Profile Methodology 25
Exhibit 15 Commercial Sector Base Year (2010) Aggregate Electric Peak Demand by Peak Period (MW) – Hydro Grid 26
Exhibit 16 Commercial Sector Base Year (2010) Aggregate Electric Peak Demand by Peak Period (MW) – Diesel Supply Regions 27
Exhibit 17 Comparison of Whole Building Electric EUIs by Sub Sector, (kWh/ft^2/yr.) 30
Exhibit 18 Commercial Sector Floor Space, by Sub Sector and Milestone Year – Hydro Region 31
Exhibit 19 Commercial Sector Floor Space, by Sub Sector and Milestone Year – Diesel Regions 32
Exhibit 20 Reference Case Annual Electricity (MWh/yr.) – Hydro Grid 33
Exhibit 21 Reference Case Annual Electricity (MWh/yr.) – Diesel Grids 36
Exhibit 22 Electric Peak Loads, by Milestone Year, Peak Period and Sub Sector (MW) – Hydro Region 39
Exhibit 23 Electric Peak Loads, by Milestone Year, Peak Period and Sub Sector (MW) – Diesel Regions 41
Exhibit 24 Energy-efficiency Technologies Included in this Study 47
Exhibit 25 Commercial Sector Energy-efficiency Technology Measures, Screening Results - Hydro Region 48
Exhibit 26 Summary of Commercial Sector Energy-efficiency Measures, 2030 50
Exhibit 27 Supply Curve - Commercial Sector, 2030 51
Exhibit 28 Technologies Included in Economic Potential Forecast 54
Exhibit 29 Reference Case versus Economic Potential Electric Energy Consumption in Commercial Sector (MWh/yr.) 55
Exhibit 30 Economic Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.) 57
Exhibit 31 Economic Potential Electricity Savings by End Use and Milestone Year (MWh/yr.) .. 58
Exhibit 32 Economic Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.) 59
Exhibit 33 Economic Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.) 60
Exhibit 34 Economic Potential Savings Distribution by Major End Use and Region - 2030 (%) . 60
Exhibit 35 Summary of Commercial Sector Energy-efficiency Measures, 2030 63
Exhibit 36 Energy-efficiency Supply Curve, Commercial Sector, 2030 65
Exhibit 37 Electric Peak Load Reductions from Economic Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector – Hydro Grid (MW) 66

Exhibit 38 Electric Peak Load Reductions from Economic Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector – Diesel Grids (kW) 68
Exhibit 39 Summary of Commercial Sector Electric Peak Load Reduction Measures 72
Exhibit 40 Commercial Sector Capacity Reduction Measures, Screening Results 73
Exhibit 41 Economic Potential Electric Capacity measures and MW Impact 74
Exhibit 42 Cumulative Supply Curve Including Gateway Costs 75
Exhibit 43 Cumulative Supply Curve with Existing Gateways (no cost) 75
Exhibit 44 Annual Electricity Consumption—Energy-efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Commercial Sector (MWh/yr.) 78
Exhibit 45 Achievable Potential versus Detailed Program Design 79
Exhibit 46 Commercial Sector Actions – Energy Efficiency 80
Exhibit 47 Participation Rate "Ramp Up" Curves 83
Exhibit 48 Summary of Achievable Potential Participation Rates and Curves 90
Exhibit 49 Electricity by Milestone Year for Three Scenarios (MWh/yr.) 91
Exhibit 50 Upper Achievable Electricity Savings for Yukon by Supply System and Government vs Non-government Customers (MWh/yr.) 93
Exhibit 51 Upper Achievable Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.) 94
Exhibit 52 Upper Achievable Potential Electricity Savings by End Use and Milestone Year (MWh/yr.) 95
Exhibit 53 Upper Achievable Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.) 95
Exhibit 54 Upper Achievable Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.). 96
Exhibit 55 Upper Achievable Potential Savings Distribution by Major End Use and Region - 2030 (%) 96
Exhibit 56 Lower Achievable Electricity Savings for Yukon by Supply System and Government vs Non-government Customers (MWh/yr.) 97
Exhibit 57 Lower Achievable Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.) 98
Exhibit 58 Lower Achievable Potential Electricity Savings by End Use and Milestone Year (MWh/yr.) 99
Exhibit 59 Lower Achievable Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.) 99
Exhibit 60 Lower Achievable Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.) 100
Exhibit 61 Lower Achievable Potential Savings Distribution by Major End Use and Region - 2030 (%) 100
Exhibit 62 Electric Peak Load Reductions, Upper and Lower Achievable Potential Scenarios (MW) 101
Exhibit 63 Electric Peak Load Reductions from Upper Achievable Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector (MW) 102
Exhibit 64 Electric Peak Load Reductions from Upper Achievable Energy Savings Measures, by Milestone Year and Sub Sector – Diesel Grids (kW) 104
Exhibit 65 Electric Peak Load Reductions from Lower Achievable Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector (MW) 105
Exhibit 66 Electric Peak Load Reductions from Lower Achievable Energy Savings Measures, by Milestone Year and Sub Sector – Diesel Grids (kW) 106

1 Introduction

1.1 Background and Objectives

Yukon residents rely on electricity not only to live meaningful, healthy lives but also to support and strengthen the economy. Given the concerns over environmental implications including climate change, and the limited generating capacity in Yukon, there is growing interest not only in how electricity is generated, transmitted and distributed but also how efficiently it is used at the customer's end. In Yukon, as well as in a growing number of North American jurisdictions, how electricity is generated and used is being closely analyzed to find innovative ways of meeting individual and corporate energy service needs while minimizing pollution and the creation of greenhouse gases.

Experience throughout many North American jurisdictions has demonstrated that energy efficiency, conservation and customer-supplied alternative energies all have a significant potential to reduce energy consumption, energy costs and emissions. The 2009 *Energy Strategy for the Yukon* also recognizes this potential and notes the following efficiency and conservation priorities:

- Avoid the cost and environmental impact of building new generation
- Increase energy efficiency in Yukon by 20% by 2020
- Reduce energy consumption in Yukon buildings
- Reduce energy consumption for transportation in Yukon
- Promote the use of energy-efficient products by providing incentives for products that meet energy performance standards
- Improve energy efficiency for Government of Yukon operations.

Efficient use of electricity through conservation, peak demand control and alternative energy sources can assist greatly in the path forward for the electrical supply industry. This conservation potential review study, referenced as CPR 2011, will provide a resource for Yukon Energy Corporation (YEC), Yukon Electrical Company Limited (YECL), and the Government of Yukon to develop a comprehensive vision of the territory's future energy service needs.

More specifically, the objective for this study is to provide:

"...a necessary reference point to determine the potential for (electricity) demand-side management (DSM) in the Yukon."[6]

---

[6] Yukon Energy Corporation Request For Proposals #2010-045, "Consulting Services for Electricity Conservation and Demand Management Potential Study," 2011.

1.2 Study Scope

The scope of this study is summarized below:

- Sector Coverage: This study addresses two sectors: residential households (Residential sector), and commercial and institutional (Commercial sector). Yukon's industrial sector consists primarily of a small number of operating mines on the grid, which are not appropriate to be included in this type of study. Efficiency opportunities within these sites are being addressed outside this study.

- Geographical Coverage: The study addresses all regions of Yukon that are served by either YEC or YECL. Customers served by both the hydroelectric grid and the stand-alone diesel grids are included. Note that the hydroelectric grid is remote, not connected to other grids, and dependent on trucked fuel to meet demand above the existing hydro/ wind capacity, while the stand-alone diesel grids rely on fuel that is trucked or flown in at all times.

- Study Period: This study covers a 20-year period. The Base Year is the calendar year 2010, with milestone periods at five-year increments: 2015, 2020, 2025 and 2030. The Base Year of 2010 was selected to enable this study's results to align with the most recent Yukon load forecasting data.[7]

- Technologies: This study addresses a comprehensive range of electric demand-side management (DSM) measures. This includes all electrical efficiency technologies or measures that are expected to be commercially viable by the year 2015, as well as peak load reduction technologies and customer-side renewable energies.

1.2.1 Data Caveat

As in any study of this type, the results presented in this report are based on a large number of important assumptions. Assumptions such as those related to the current penetration of energy-efficient technologies, the rate of future growth in the stock of commercial buildings and customer willingness to implement new energy-efficiency measures are particularly influential.

Wherever possible, the assumptions used in this study are consistent with those used by YEC, YECL and the Government of Yukon and are based on best available information, which in many cases includes the professional judgment of the consultant team, client personnel and local experts. The reader should, therefore, use the results presented in this report as best available estimates; major assumptions, information sources and caveats are noted throughout the report.

1.3 Study Organization

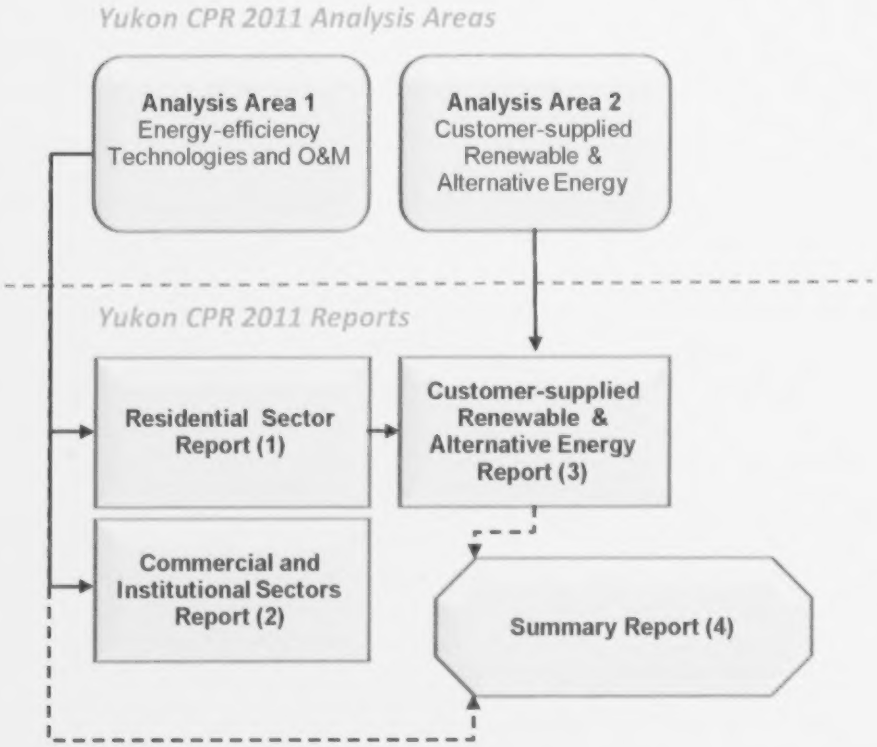
Exhibit 1 presents an overview of the study's organization; as illustrated, the study has been organized into two analysis areas and four individual reports.

A brief description of each analysis area and its report content is provided below.

---

[7] Load forecasting data provided by YEC, April 2011.

Exhibit 1 Overview of CPR 2011 Organization – Analysis Areas and Reports


Yukon CPR 2011 Analysis Areas
Analysis Area 1
Energy-efficiency Technologies and O&M
Analysis Area 2
Customer-supplied Renewable & Alternative Energy
Yukon CPR 2011 Reports
Residential Sector Report (1)
Customer-supplied Renewable & Alternative Energy Report (3)
Commercial and Institutional Sectors Report (2)
Summary Report (4)

1.3.1 Analysis Area 1 – Energy-efficiency and Peak Load Technologies and O&M

This area of the CPR 2011 assesses electric energy[8] and peak load reduction opportunities that could be provided by electrical efficiency and peak load reduction technologies that are expected to be commercially viable by the year 2015; operation and maintenance (O&M) practices are also addressed. The results of Analysis Area 1 are presented in two individual sector reports and summarized in a Summary Report.

1.3.2 Analysis Area 2 – Customer-Supplied Renewable Energies

This area of the CPR 2011 assesses electric energy and peak load reduction opportunities that could be provided by customer-supplied renewable energies. The results of Analysis Area 2 are presented in a single report and summarized in a Summary Report.

1.4 Report Organization

This report presents the Commercial sector results; it is organized and presented as follows:

- Section 2 presents an overview of the study methodology, including a definition of key terms and an outline of the major analytic steps involved

---

[8] The term "electric energy" is used in this report to distinguish electricity consumption (in units of kWh or MWh) from electricity demand during a specific period (in units of MW).

- Section 3 presents a profile of Commercial sector Base Year electricity use in Yukon
- Section 4 presents a profile of Commercial sector Base Year electric peak load, including the definition of peak periods that are included in this study
- Section 5 presents the Reference Case, which provides a detailed estimate of electricity use in Yukon's Commercial sector over the study period 2010 to 2030, in the absence of new utility DSM program initiatives
- Section 6 presents the Reference Case electric peak loads, which provide a detailed estimate of peak load requirements in Yukon's Commercial sector over the study period 2010 to 2030, in the absence of new utility DSM program initiatives
- Section 7 identifies and assesses the economic attractiveness of the selected energy-efficiency technology measures for the Commercial sector
- Section 8 presents the Commercial sector Economic Potential Electricity Forecast for the study period 2010 to 2030
- Section 9 identifies and assesses the economic attractiveness of selected Commercial sector electric capacity-only peak load reduction measures, which in this study are defined as those measures that affect electric peak but have minimal or no impact on daily, seasonal or annual energy use
- Section 10 presents the estimated upper and lower Achievable Potential for electric energy savings for the study period 2010 to 2030
- Section 11 lists sources and references
- Section 12 is the Glossary.

1.5 Results Presentation

The preparation of Conservation Potential Reviews involves the compilation and analysis of an enormous amount of market and technology data, resulting in a nearly infinite number of ways of organizing and presenting the results. It is recognized that readers will have differing levels of need with respect to the level of detail provided. Consequently, the results of this CPR are presented at three levels of detail.

- **Main report body.** The main body of the report provides a relatively high-level reporting of the main steps involved in undertaking each stage of the study together with a concise summary of results, including comments and interpretation of key findings. It is assumed that the content and level of detail in the main report body is suitable for the majority of readers who wish to gain an understanding of the potential contribution of DSM options to Yukon's long-term electricity requirements.
- **Appendices.** A separate appendix accompanies each major section of the main report. Each appendix provides more detailed information on the methodology employed, including major assumptions or sample calculations as applicable, together with additional levels of results. It is assumed that this presentation is better suited to DSM analysts and managers wishing a more thorough understanding of the study results.

- **Software.** All of the data generated by the study is provided in two custom-designed Excel models: Data Manager and the measure TRC (total resource cost) model.
    - **Data Manager** is a custom-designed Excel workbook with query protocols that enable the user to search and report the study results in a virtually infinite number of combinations. Data Manager is intended to support the most detailed level of DSM activity such as program design, preparation of regulatory submissions, etc.
    - **The measure TRC model** is a custom-designed model that provides comprehensive profiles of the DSM measures assessed within the study. Because the information is provided in software form, any changes to economic, financial or performance data inputs can be easily accommodated and revised results generated automatically.

2 Study Methodology

This section provides an overview of the methodology employed for this study. More specifically, it addresses:

- Definition of terms
- Major analytic steps
- Analytic models.

2.1 Definition of Terms

This study uses numerous terms that are unique to analyses such as this one and consequently it is important to ensure that readers have a clear understanding of what each term means when applied to this study.

A brief description of some of the most important terms and their application within this study is included below.

Base Year Electricity Use	The Base Year is the starting point for the analysis. It provides a detailed description of where and how electrical energy is currently used in the existing Commercial sector building stock. Building electricity use simulations were undertaken for the major sub sector types and calibrated to actual utility customer billing data for the Base Year. As noted previously, the Base Year for this study is the calendar year 2010.
Base Year Electric Peak Load Profile	Electric peak load profiles refer to specific time periods throughout the year when Yukon's generation, transmission and distribution system experiences particularly high levels of electricity demand. These periods are of particular interest to system planners; improved management of electricity demand during these peak periods may enable deferral of costly system expansion. This study addresses three specific peak periods, as outlined in the main text.
Reference Case Electricity Use	The Reference Case electricity use estimates the expected level of electrical energy consumption that would occur over the study period in the absence of new (post-2010) utility-based DSM initiatives. It provides the point of comparison for the subsequent calculation of Economic and Achievable electricity savings potentials. Creation of the Reference Case required the development of profiles for new buildings in each of the sub sectors, estimation of the expected growth in building stock, and finally an estimation of "natural" changes affecting electricity consumption over the study period. The Reference Case considers YEC's most recent load forecasting data, and excludes the impacts of future DSM initiatives.
Reference Case Electric Peak Load Profile	The Reference Case peak load profile estimates the expected electric peak loads in each of the three defined peak periods over the study period in the absence of new utility DSM program initiatives. It provides the point of comparison for the subsequent calculation of Economic and Achievable Potentials for peak load reduction.

Demand-Side Management (DSM) Measures	DSM measures can include energy efficiency (use more efficiently), energy conservation (use less), demand management (use less during peak periods), fuel switching (use a different fuel to provide the energy service) and customer-side generation (displace load off of grid). Fuel switching is not included in this study.
The Cost of Conserved Energy (CCE)	The CCE is calculated for each energy-efficiency measure. The CCE is the annualized incremental capital and O&M cost of the upgrade measure divided by the annual energy savings achieved, excluding any administrative or program costs. The CCE represents the cost of conserving one kWh of electricity; it can be compared directly to the cost of supplying one new kWh of electricity.
The Cost of Electric Peak Reduction (CEPR)	The CEPR for a peak load reduction measure is defined as the annualized incremental capital and O&M cost of the measure divided by the annual peak reduction achieved, excluding any administrative or program costs. The CEPR represents the cost of reducing one kW of electricity during a peak period; it can be compared to the cost of supplying one new kW of electric capacity during the same period.
Electric Capacity-Only Peak Load Reduction Measures	Capacity-only measures are technologies or activities that result in the shifting of certain electrical loads from periods of peak system demand to periods of lower system demand.
Economic Potential Electricity Forecast	The Economic Potential Electricity Forecast is the level of electricity consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective against the economic threshold value,[9] which has been set at different prices per kWh for the different supply system types. (One kWh from the hydroelectric grid is much less expensive than one kWh from the diesel grid in Old Crow.) All the energy-efficiency upgrades included in the technology assessment that had a CCE equal to, or less than, the economic threshold value for a given supply system were incorporated into the Economic Potential Forecast.
Economic Potential Electric Peak Load Forecast	The Economic Potential Electric Peak Load Forecast is the expected electric peak loads that would occur in each of the three defined peak periods if all peak load reduction measures that are cost effective against the future avoided cost of new capacity in Yukon were fully implemented.
Achievable Potential	The Achievable Potential is the proportion of the savings identified in the Economic Potential Forecasts that could realistically be achieved within the study period. The Achievable Potential recognizes that it is difficult to induce customers to purchase and install all the electrical efficiency technologies that meet the criteria defined by the Economic Potential Forecast. The results are presented as a range, defined as lower and upper.

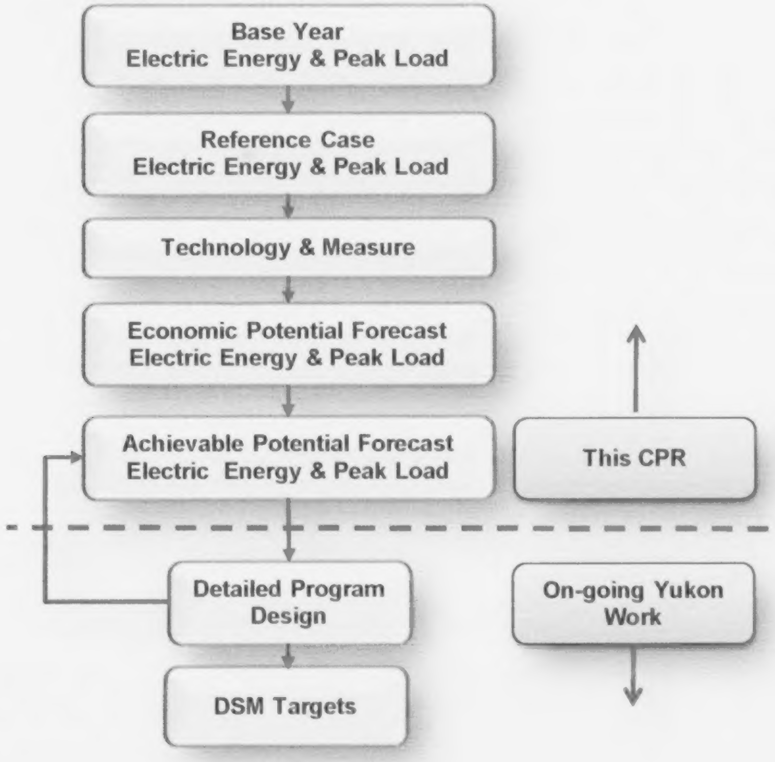
---

[9] The economic threshold value is related to the cost of new avoided electrical supply. The values for each supply system were selected to provide the CPR with a reasonably useful time horizon (life) to allow planners to examine options that may become more cost effective over time. Further discussion is provided in Section 8 of this report.

2.2 Major Analytic Steps

The study was conducted within an iterative process that involved a number of well-defined steps, as illustrated in Exhibit 2.

Exhibit 2 Major Analytic Steps


Base Year
Electric Energy & Peak Load
Reference Case
Electric Energy & Peak Load
Technology & Measure
Economic Potential Forecast
Electric Energy & Peak Load
Achievable Potential Forecast
Electric Energy & Peak Load
This CPR
Detailed Program Design
On-going Yukon Work
DSM Targets

A summary of the steps is presented below.

Step 1: Develop Base Year Electric Energy and Peak Load Calibration Using Actual Utility Billing Data

Build a model of electric energy and demand for the sector, disaggregated to all the building types and end uses, calibrated to sales of electricity in Yukon. This includes the following sub-steps:

- Compile and analyze available data on Yukon's existing building stock.
- Develop detailed technical descriptions of the existing building stock.
- Undertake computer simulations of electricity use in each building type and compare these with actual building billing and audit data.

- Compile actual utility billing data.
- Create sector model inputs and generate results.
- Calibrate sector model results using actual utility billing data.
- Use end-use load shape data to convert electric energy use to electric demand in each selected peak period.

Step 2: Develop Reference Case Electric Energy Use and Peak Load Profile

Extend the base year model to the end of the study period, based on forecast building stock growth and expected natural changes in construction practices, equipment efficiency levels and/or practices. This includes the following sub-steps:

- Compile and analyze building design, equipment and operations data and develop detailed technical descriptions of the new building stock.
- Develop computer simulations of electricity use in each new building type.
- Compile data on forecast levels of building stock growth and "natural" changes in equipment efficiency levels and/or practices.
- Define sector model inputs and create forecasts of electricity use for each of the milestone years.
- Compare sector model results with YEC load forecasting data for the study period.
- Use end-use load shape data to convert electric energy use to electric demand in each selected peak period over the study period.

Step 3: Identify and Assess Energy-efficiency and Peak Load Reduction Measures

Compile information on upgrade measures that can save electric energy and/or reduce peak demand, and assess them for technical applicability and economic feasibility. This includes the following sub-steps:

- Develop list of energy-efficiency upgrade and peak load reduction measures.
- Compile detailed cost and performance data for each measure.
- For energy-efficiency measures, identify the baseline technologies employed in the Reference Case, develop energy-efficiency upgrade options and associated electricity savings for each option, and determine the Cost of Conserved Energy (CCE) for each upgrade option.
- For each peak load reduction measure, identify the affected end use, the potential load reduction or off-peak shifting and determine the Cost of Electric Peak Reduction (CEPR).

- Based on the above results, prepare summary tables that show the amount of potential peak load reduction provided by each measure and at what cost ($/kW/yr.).

- Apply each peak load reduction measure to the affected end use, regardless of cost, and determine total peak reduction.

- Summarize the peak load reduction impacts in a supply curve.

Step 4: Estimate Economic Electricity Savings Potential

Develop an estimate of the electric energy savings potential that would result from implementing all of the economically feasible measures in all the buildings where they are applicable. This includes the following sub-steps:

- Compile utility economic data on the forecast cost of new electricity generation and set an economic threshold value; different economic threshold values were selected for each supply system (hydroelectric and diesel grids).

- Identify the combinations of energy-efficiency upgrade options and building types where the cost of saving one kilowatt of electricity is equal to, or less than, the cost of new electricity generation.

- Apply the economically attractive electrical efficiency measures from Step 3 within the energy-use simulation model developed previously for the Reference Case.

- Determine annual electricity consumption in each building type and end use when the economic efficiency measures are employed.

- Compare the electricity consumption levels when all economic efficiency measures are used with the Reference Case consumption levels and calculate the electricity savings.

Step 5: Estimate Achievable Potential Electricity Savings

Develop an estimated range for the portion of economic potential savings that would likely be achievable within realistic DSM programs. This includes the following sub-steps:

- Bundle the electric energy and peak load reduction opportunities identified in the Economic Potential Forecasts into a set of opportunities.

- For each of the identified opportunities, create an Opportunity Profile that provides a high-level implementation framework, including measure description, cost and savings profile, target sub sectors, potential delivery allies, barriers and possible synergies.

- Review historical Achievable program results and prepare preliminary Assessment Worksheets.

- Conduct a full day workshop involving the client, the consultant team, trade allies and technical experts to reach general agreement on the upper and lower range of Achievable Potential.

Step 6: Estimate Peak Load Impacts of Electricity Savings

Develop an estimate for the peak load impacts associated with the measures that save electric energy. This includes the following sub-steps:

- The electricity (electric energy) savings (MWh) calculated in the preceding steps were converted to peak load (electric demand) savings (MW).[10]

- The conversion of electricity savings to hourly demand drew on a library of specific sub sector and end-use electricity load shapes. Using the load shape data, the following steps were applied:
    - Annual electricity savings for each combination of sub sector and end use were disaggregated by month
    - Monthly electricity savings were then further disaggregated by day type (weekday, weekend day and peak day)
    - Finally, each day type was disaggregated by hour.

2.3 Analytical Models

The analysis of the Commercial[11] sector employs two linked modelling platforms:

- CEEAM (Commercial Electricity and Emissions Analysis Model), an in-house, simulation model developed in conjunction with Natural Resources Canada (NRCan) for modelling electricity use in commercial/institutional building stock.

- CSEEM (Commercial Sector Electricity End-use Model), an in-house spreadsheet-based macro model.

CEEAM was used to develop commercial electricity end-use intensities (EUIs) for each of the commercial and institutional building archetypes. CEEAM has been successfully employed in numerous domestic and international conservation and demand management projects.

Domestically, this includes assignments for BC Hydro, FortisBC, SaskPower, Manitoba Hydro, the Ontario Power Authority (OPA), Enbridge Gas, Union Gas, NB Power, Newfoundland Power, Newfoundland Labrador Hydro and Natural Resources Canada. CEEAM is a robust modelling platform whose results have been verified against actual end-use metered data for commercial buildings in the cities of Ottawa and Toronto and against results from DOE-2, the widely used building simulation software tool developed by the U.S. Department of Energy.

CEEAM was developed specifically for applications such as this study. One of its particular strengths is the capability to simulate electricity performance not only in a given building but also in an entire stock of similar buildings (e.g., all Large Offices). In particular, it is capable of tracking the penetration of multiple technologies in combinations that are not possible with other simulation software tools, such as DOE-2.

---

[10] Peak load savings were modelled using the Load Shape Library Model (LOADLIB).

[11] Unless otherwise noted, the term "commercial" is used in this report to refer to all buildings on a general service rate, including commercial and institutional buildings, as well as light industrial and manufacturing facilities.

CEEAM simulates the electricity consumption and peak load for all electricity end uses present in a given commercial building segment. CEEAM calculates energy use and emissions by end use and reports them in kWh/ft^2/yr. and kg eCO$_2$/ft^2. Because CEEAM is a full modelling program, it calculates both building heating and cooling loads (internal and transmission). It therefore accounts for interactive effects such as the increase in heating energy use and decrease in cooling energy use resulting from lighting retrofits. CEEAM also uses equipment part load performance curves to accurately model the seasonal efficiency of heating and cooling plants.

The commercial EUIs derived by CEEAM provide inputs into CSEEM. CSEEM consists of two modules:

- A general parameters module that contains general sector data (e.g., floor space, growth rates, etc.).
- A building profile module that contains the EUI data for each of the selected building sub sectors.

CSEEM combines data from each of these modules and provides total electricity use by service region, building sub sector and end use. CSEEM also enables the analyst to estimate the demand impacts of the electrical efficiency measures introduced in the Economic Potential Forecast.

3 Base Year (2010) Electric Energy Use

3.1 Introduction

This section provides a profile of Base Year (2010) electricity use in Yukon's Commercial sector. Development of the Commercial sector Base Year electricity profile required the following major steps:

- Yukon buildings served under a General Service rate class were segmented into sub sectors containing buildings with similar energy use patterns
- The major energy end uses within commercial buildings were selected
- Data on end-use fuel shares and space cooling saturation were compiled for each sub sector
- Detailed building and equipment specifications were compiled and used to create building energy-use models for each sub sector
- Utility sales data were compiled for each sub sector
- Utility sales data were combined with the model results showing typical sub sector electricity use to generate an estimate of floor area for each sub sector
- CSEEM was used to combine the above data and provide the detailed Base Year profile.

A brief description of each of the above steps is provided below, together with a summary of the results. Additional information is provided in Appendix A.

3.2 Commercial Sector Segmentation

The first major task in developing the Base Year calibration involved the segmentation of the commercial building stock into specific sub sectors. The choice of building sub sectors is driven by both data availability and the need to facilitate the subsequent analysis and modelling of potential electrical efficiency improvements.

For modelling and analysis of energy-efficiency opportunities, the selected building sub sectors must be reasonably similar in terms of major design and operating considerations, such as building size, typical mechanical and electrical systems, annual operating hours, etc. In order to facilitate energy modelling, this report deals primarily with buildings in which energy use is dominated by space conditioning and the provision of services to occupants (i.e., lighting and water heating). As discussed below, buildings or plants where energy use is primarily process-driven are segregated in to a separate category and treated at a less detailed level.

A summary of the Commercial sub sectors that are used in this study is provided in Exhibit 3.

Exhibit 3 Commercial Sub Sectors

- Office
- Food Retail
- Non-Food Retail
- Hotel/Motel
- Healthcare
- Education
- Restaurant & Tavern
- Recreation Centres
- Warehouse/Wholesale
- Other General Service Buildings[12]
- Street Lighting
- Non-Buildings
- Parking Lot Plug[13]
- General Service Buildings – Diesel Rate Zones
- Non-Buildings – Diesel Rate Zones
- Street Lighting – Diesel Rate Zones

In addition, government customers are tracked separately by sub sector and are reported on separately where appropriate.

A brief description of each Commercial sub sector shown in Exhibit 4 is included in Appendix A. Additional explanation is provided for selected sub sectors:

Recreation Centres. This sub sector includes buildings such as skating rinks and curling rinks with both natural and artificial ice.

Other General Service Buildings. This sub sector represents buildings that do not fit into the specific sub sectors shown in Exhibit 3 including churches, theatres, service stations and transportation buildings, as well as buildings with a significant "process" load such as placer mines, manufacturing facilities and light industrial facilities. This sub sector is not subjected to the same detailed analysis as the other building sub sectors.

Non-buildings. This sub sector includes facilities such as microwave repeater stations and telephone exchanges. Although these accounts are sometimes associated with a "building," the majority of their electricity use is consumed by the unique equipment that they house. This sub sector will be tracked throughout the study but will not be subjected to detailed analysis.

3.3 End Uses

Electricity use within each of the sub sectors noted above is further defined on the basis of specific end uses. In this study, the term "end use" is defined as "the final application or final use to which energy is applied. End uses are the services of economic value to the users of energy." A summary of the Commercial sector end uses used in this study, as well as a brief description of each, is provided in Exhibit 4.

---

[12] The Other General Service Buildings sub sector exclude sales data associated with Alexco and ARM mine sites, which fall outside the scope of this study.

[13] The Parking Lot Plug sub sector includes only those accounts serving separately metered parking lot receptacles.

Exhibit 4 Commercial Sector End Uses

End-Use	Description/Comments
General lighting	▪ Lighting in main function areas of building - typically linear fluorescent
Architectural lighting	▪ Lighting in lobbies, corridors, stairwells, etc. – typically incandescent or compact fluorescent.
High-bay lighting	▪ High-bay lighting in warehouses, gymnasiums, etc.
Outdoor lighting	▪ Security lighting, outdoor signage, parking lot lights
Space heating	▪ Electric boilers, unit heaters, baseboard heaters, portable space heaters, heat pumps, etc.
Space cooling	▪ Compressors associated with chillers and DX equipment
HVAC fans & pumps	▪ Auxiliaries including fans, pumps, cooling tower fans
DHW	▪ DHW boilers, tank heaters
Computers & office equipment	▪ Computers, monitors, servers, printers, copiers, etc.
Other plug loads	▪ Receptacle loads except computers & office equipment
Cooking equipment	▪ Food preparation equipment including ranges, broilers, ovens
Refrigeration	▪ Fridges, coolers, display cases, walk-in coolers and freezers, open coolers, open freezers, ice plants (in ice rinks)
Miscellaneous	▪ Miscellaneous equipment including elevators, trace heating, etc.
Street lighting	▪ Roadway lighting
Block Heater	▪ Separately metered parking lot receptacles serving automotive block heaters.

3.4 End-use Saturation and Fuel Share Data

The next step in the analysis involved an estimation of the electric fuel share for space heating, domestic hot water (DHW) and cooking equipment,[14] and an estimation of the saturation for space cooling.[15] A number of information sources were used to derive these estimates. They included: analysis of Yukon's sales data; previous project team experience; comparable data from other Canadian jurisdictions contained in the Marbek database; and, consultations with local Yukon technical advisors.

---

[14] Space heating fuel share refers to the percentage of the total floor space that is electrically heated; similarly, DHW fuel share refers to the percentage of the total floor space that is served by electrically heated domestic hot water. Cooking fuel share refers to the electric portion of end-use energy.

[15] Space cooling saturation refers to the percentage of the total floor space that is air conditioned.

Exhibit 5 and Exhibit 6 present the estimated fuel shares and space cooling saturations for each sub sector.

Exhibit 5 Electric Fuel Share by Sub Sector (%)

Sub Sector	End Use		
	Space Heating	Water Heating	Cooking
Office	30%	50%	95%
Food Retail	20%	40%	40%
Non-food Retail	20%	30%	100%
Hotel / Motel	20%	15%	25%
Healthcare	10%	10%	25%
Education	10%	50%	50%
Restaurant	15%	15%	25%
Recreation Centres	3%	10%	90%
Warehouse / Wholesale	5%	15%	100%
Other General Service Buildings	25%	40%	98%

Exhibit 6 Space Cooling Saturation by Sub Sector (%)

Sub Sector	Space Cooling Saturation
Office	75%
Food Retail	65%
Non-food Retail	65%
Hotel / Motel	65%
Healthcare	65%
Education	5%
Restaurant	65%
Recreation Centres	5%
Warehouse / Wholesale	5%
Other General Service Buildings	70%

3.5 Detailed Building and Equipment Specifications

The next major task involved the development of detailed technical data on building specifications, mechanical and electrical equipment, operating practices and electricity use for each sub sector and end use identified above.

To facilitate the subsequent analysis of the potential impacts of energy-efficiency measures, the detailed data on building, equipment and operating practices were compiled within Marbek's Commercial/Institutional Building Energy-use Simulation Model (CEEAM). Detailed building profiles were created that represent the stock of buildings within each sub sector. The detailed technical profiles constitute a bottom-up profile of energy use in the targeted sub sectors.

Development of the detailed building profiles relied on an analysis of data sources, primarily:

- Consultations with local technical advisors and building managers
- Professional experience of the study team personnel including building site visits in Yukon and other jurisdictions.

Separate building profiles were developed for each sub sector within the hydro region. EUIs for each sub sector within the three diesel grids were estimated by scaling resulting weather-sensitive loads (space heating and space cooling) based on heating degree days and cooling degree days for a typical meteorological year (TMY) within each service region. EUIs for end uses which are not weather sensitive are assumed to be consistent across all four regions. The service regions and the weather data used in this study are noted below:

- The hydro region (using Whitehorse climate data)
- The large diesel region (using Watson Lake climate data)
- The small diesel region (using blended Burwash / Beaver Creek climate data)
- The Old Crow region (using Old Crow climate data).

Exhibit 7 presents a sample building profile summary. Detailed profiles for each existing building sub sector are provided in Appendix A.

Exhibit 7 Sample Building Profile Summary – Existing Office

Building Type: Small Office

Location: Yukon

Description:
This is an archetype of an Office building. The inputs used to develop this model include Marbek's Building Energy Performance Database, consultation with engineering practitioners and information gathered as part of market share surveys in various jurisdictions.

The Typical Building:
The typical building characteristics used to define this building profile are as follows:
- Average gross floor area of 15,000 ft² (approx 1,400 m²)
- Average footprint of 7,500 ft² (approx 700 m²)
- Average height of 2 stories

Building Envelope:

Roof U Value	0.29 W/m².°C
Wall U Value	0.38 W/m².°C
Window U Value	3.30 W/m².°C
Shading Coefficient (SC)	0.58
Window to Wall Ratio (WWR)	0.35

General Lighting: 500 Lux 1.3 W/ft² 90% Floor Fraction (GLFF)

System Types

T12 ES	T8 Mag	T8 Elec
50%	0%	50%

Architectural Lighting: 350 Lux 3.1 W/ft² 10% Floor Fraction (GLFF)

System Types

INC	CFL	Other
50%	50%	0%

High Bay Lighting: 0 Lux 0.0 W/ft² 0% Floor Fraction (GLFF)

System Types

0%	MH	HPS
0%	0%	0%

Overall LPD 1.5 W/ft²

Space Heating Load 739 MJ/m².yr. P. Design 96.7 W/m²

System Types

Fossil Fuel			Electric				
Boilers		Pkgd. Units	A/A HP	W. S. HP	H/R Chiller	Resistance	
Std.	HE						
30%	30%	10%	10%	10%	0%	10%	100%

Space Cooling Load 59 MJ/m².yr

System Types

Centrifugal		Reciprocating		Adsorption Chillers		
Std	HE	Open	DX	WH	CW	
0%	0%	0%	100%	0%	0%	100%

Fans

System Types

CAV	VAV
75%	25%

System Air Flow 0.6 CFM/ft²
Fan Power 0.3 W/ft²

Pumps

Circulating pumps 0.0 W/ft²
Condenser Pumps 0.1 W/ft²

Incidence of Temperature Setback 25%

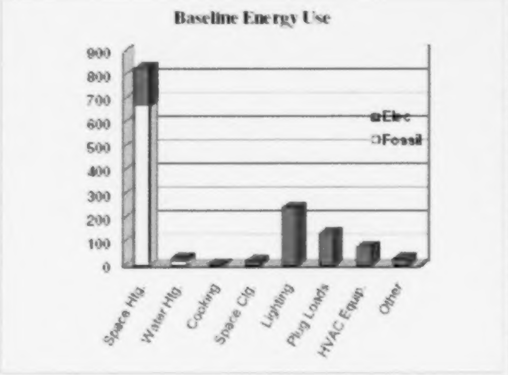
Incidence of Ventilation System Shutdown 50%

Minimum OA 0.29 L/s.m² 0.06 CFM/ft²

Water Heating Load 22.75 MJ/m².yr.

System Types

Fossil Fuel		Elec. Res.	
Tank	Boiler		
50%	0%	50%	100%



Energy Performance Summary

Fossil Fuel End Use	MJ/m².yr.	ekWh/ft².yr.
Space Heating	671	17.3
Water Heating	18	0.5
Cooking	0	0.0
Other	0	0.0
Subtotal	689	18
Electrical End Use	**MJ/m².yr.**	**kWh/ft².yr.**
Lighting	244	6.3
Plug Loads & Office Equipment	135	3.5
HVAC Fans and Pumps	76	2.0
Space Heating	160	4.1
Space Cooling	17	0.4
Water Heating	13	0.3
Cooking	4	0.1
Other	28	0.7
Subtotal	677	17.5
Total	1366	35.3

3.6 Floor Area Calculations

The addition of floor area is used to drive changes in Yukon's commercial building stock over the study period, including changes to equipment and electricity use. For the purposes of this study, floor space was derived by dividing the actual sales data for each building sub sector by the applicable fuel share and saturation-weighted whole-building electricity use intensity (EUI). Exhibit 8 shows the resulting estimates of floor area within each building sub sector for the hydro Grid, while Exhibit 9 provides estimates of the total commercial floor area in each of the three diesel grids.

Exhibit 8 Base Year Floor Area by Sub Sector – Hydro Grid

Sub Sector	Floor Area (ft^2)
Office	1,364,000
Food Retail	195,000
Non-food Retail	912,000
Hotel / Motel	618,000
Healthcare	209,000
Education	1,742,000
Restaurant	195,000
Recreation Centres	499,000
Warehouse / Wholesale	1,439,000
Other General Service Buildings	1,782,000
Grand Total	8,955,000

Exhibit 9 Base Year Floor Area – Diesel Grids

Diesel Grid	Floor Area (ft^2)
Large Diesel	464,000
Small Diesel	118,000
Old Crow	57,000
Grand Total	639,000

Note: Any differences in totals are due to rounding.

The total estimated floor area is 9.6 million square feet; approximately 93% is in the hydro grid region. Within the hydro grid, the Other General Service Buildings sub sector accounts for 20% of the floor area, followed by Education at 19%, Warehouse/Wholesale at 16% and Offices 15%.

3.7 Commercial Base Year Electricity Use

This section presents the results of the analysis of electricity consumption for the Base Year 2010. Electricity consumption is measured at the customer's point-of-use and does not include line losses.

Exhibit 10 presents total Commercial sector electricity consumption by building sub sector and end use, while Exhibit 11 through Exhibit 13 present the results by sub sector, end use and supply type respectively. Additional highlights are noted below.

Base Year Electricity Use by Sub Sector

Other General Service Buildings account for the largest share of electricity use within the building sub sectors (18%), followed by Office (14%), and Education, Warehouse/Wholesale and Non-food Retail at 9% each.

Non-buildings account for 13% of Base Year Commercial sector electricity use.

Base Year Electricity Use by End Use

Lighting is the largest Commercial sector end use, accounting for approximately 37% of total Commercial sector electricity use. Indoor lighting, which consists of general, architectural and high-bay lighting, accounts for approximately 34%, while outdoor lighting accounts for the remaining 3%.

Space heating is the second largest end use, accounting for 13% of Commercial sector electricity use followed by refrigeration (9%), HVAC fans & pumps (8%), and computer equipment (6%). Cooking equipment, domestic water heating and a number of smaller end uses account for the remaining Commercial sector electricity use.

Non-building loads are treated as both an end use and sub sector in this analysis. These loads account for 13% of Commercial sector end use electricity consumption.

Base Year Supply Type

The accounts connected to the hydro grid consume approximately 94% of commercial electricity. Accounts connected to large diesel grid consume approximately 4% of commercial electricity. Accounts connected to small diesel grids consume approximately 1% of commercial electricity, while accounts in the fly-in community of Old Crow account for less than 1%.

Government accounts make up approximately one-third of commercial electricity use.

Exhibit 10 Base Year Annual Electricity Consumption by Sub Sector and End Use (MWh/yr.)

Sub Sector	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Office	6,006	1,989	-	597	5,637	569	2,680	440	3,783	975	134	141	841	-	-	-	23,792
Food Retail	588	579	993	257	547	38	473	101	171	164	121	6,056	50	-	-	-	10,137
Non-food Retail	4,647	2,477	929	799	1,938	152	1,274	134	490	587	236	353	236	-	-	-	14,252
Hotel / Motel	805	1,443	-	271	2,025	136	912	622	338	305	199	479	221	-	-	-	7,756
Healthcare	1,165	430	-	183	640	43	1,220	70	232	363	108	81	96	-	-	-	4,630
Education	3,576	1,413	545	382	2,961	48	1,536	988	1,070	871	450	450	225	-	-	-	14,514
Recreation Centres	480	256	1,793	547	156	3	327	128	25	207	290	2,397	129	-	-	-	6,739
Restaurant	431	1,556	-	554	1,147	62	623	331	95	125	816	1,758	50	-	-	-	7,549
Warehouse / Wholesale	829	681	5,993	630	1,043	6	859	111	658	597	149	2,601	372	-	-	-	14,529
Other Gen Service	8,462	3,719	907	1,171	5,434	507	2,995	405	2,950	1,210	314	437	779	-	-	-	29,290
General Service - Diesel Grids	1,798	1,100	718	382	60	125	958	316	636	387	228	967	208	-	-	-	7,885
Non-Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	20,795	-	-	20,795
Street lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,917	-	3,917
Parking Lot Plug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	348	348
Grand Total	28,786	15,643	11,878	5,773	21,587	1,689	13,859	3,647	10,450	5,792	3,044	15,719	3,207	20,795	3,917	348	166,133

Exhibit 11 Distribution of Electricity Consumption by Sub Sector, Base Year (2010)

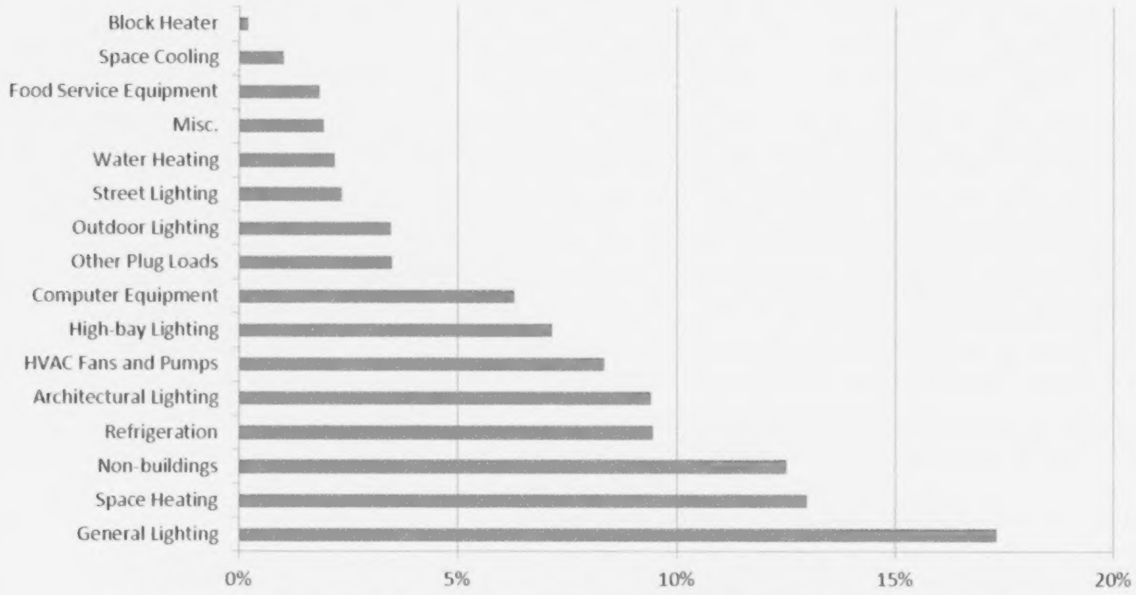


Exhibit 12 Distribution of Electricity Consumption by End Use, Base Year (2010)

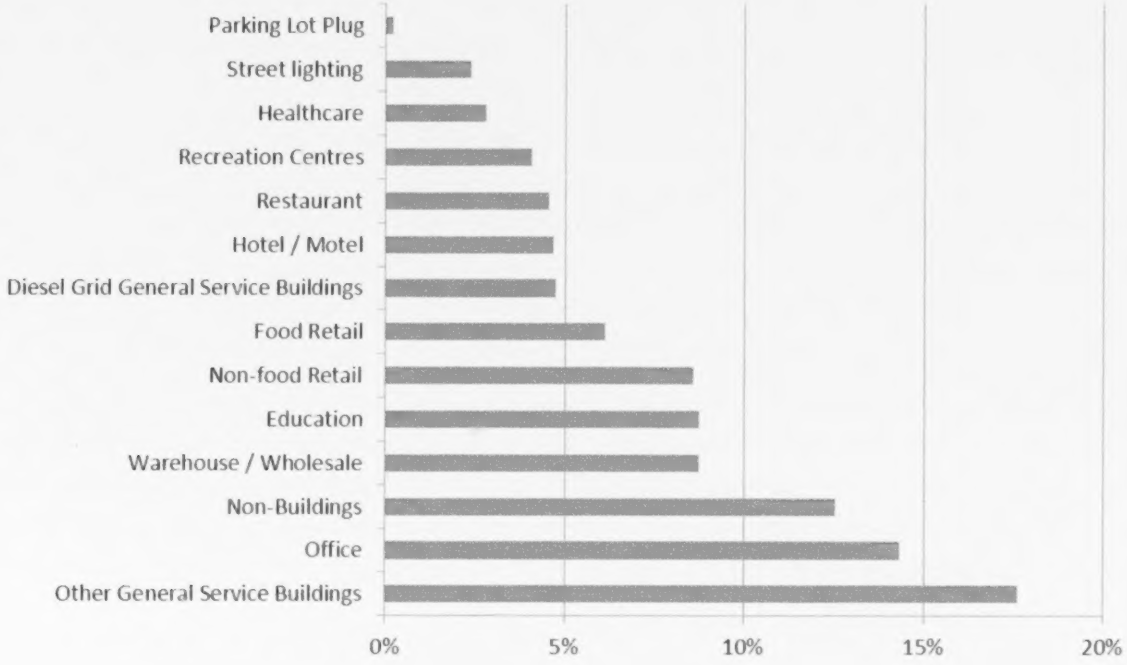
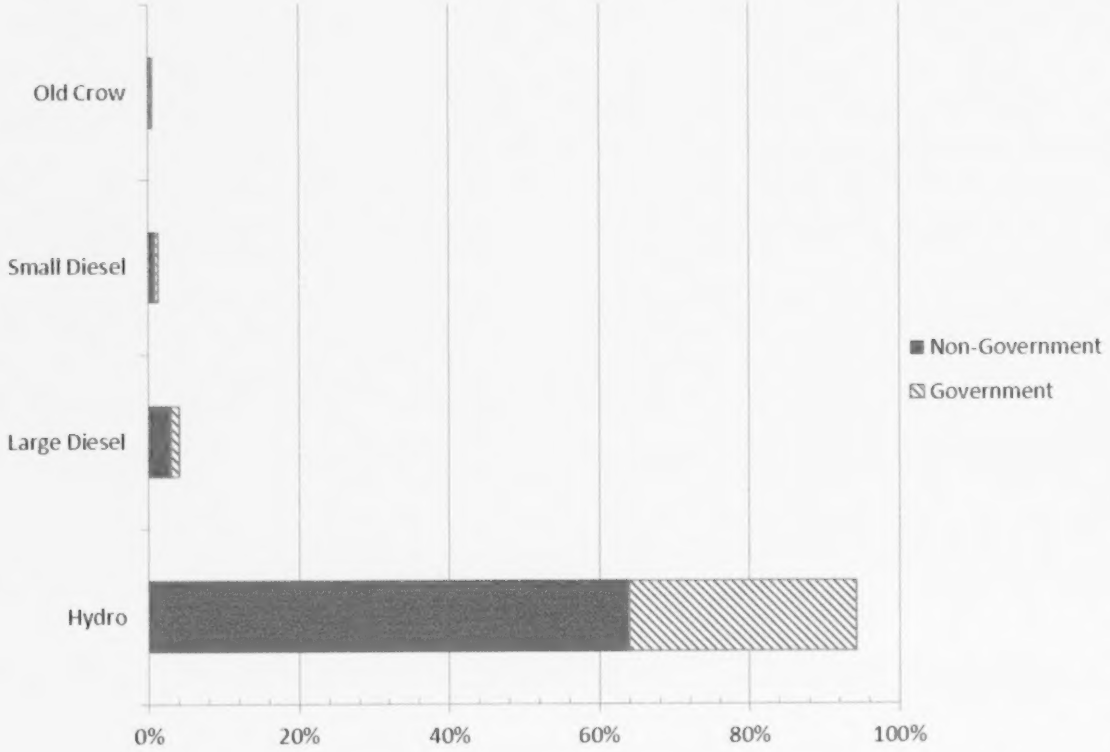


Exhibit 13 Distribution of Electricity Consumption by Supply Type and Government versus Non-government, Base Year (2010)



4 Base Year (2010) Electric Peak Load

4.1 Introduction

This section provides the electric peak load profile for the Base Year (2010) for Yukon's Commercial sector. The discussion is organized into the following subsections:

- Peak period definitions
- Methodology
- Summary of results.

Additional details are provided in Appendix B.

4.2 Peak Period Definitions

Based on discussions with utility personnel, the following three peak period definitions were selected for inclusion in this study:

Peak Period 1: Annual System Peak Hour –This has traditionally been the hour ending at 6 pm on a day in December; it is highly correlated with the coldest day of the year when occurring in December, although it has sometimes occurred in January.

Peak Period 2: Annual Weekday System Evening Peak Period – The 4-8 pm period on the coldest four days of the year when occurring in December or January (total 16 hours).

Peak Period 3: Annual Weekday System Morning Peak Period – The 7-9 am period on the 10 coldest days of the year when occurring in December or January (total 20 hours).

4.3 Methodology

The electric peak load profile converts the annual electric energy use (MWh) presented in Section 3 to hourly demand (MW). Development of the electric peak load estimates employed four specific factors, which are described below and shown graphically in Exhibit 14.

Monthly Usage Allocation Factor: This factor represents the percent of annual electric energy usage that is allocated to each month. This set of monthly fractions (percentages) reflects the seasonality of the load shape, whether a facility, process or end use, and is dictated by weather or other seasonal factors. In decreasing order of priority, this allocation factor can be obtained from either:

- Monthly consumption statistics from end-use load studies

- Monthly seasonal sales (preferably weather normalized) obtained by subtracting a "base" month from winter and summer heating and cooling months, or

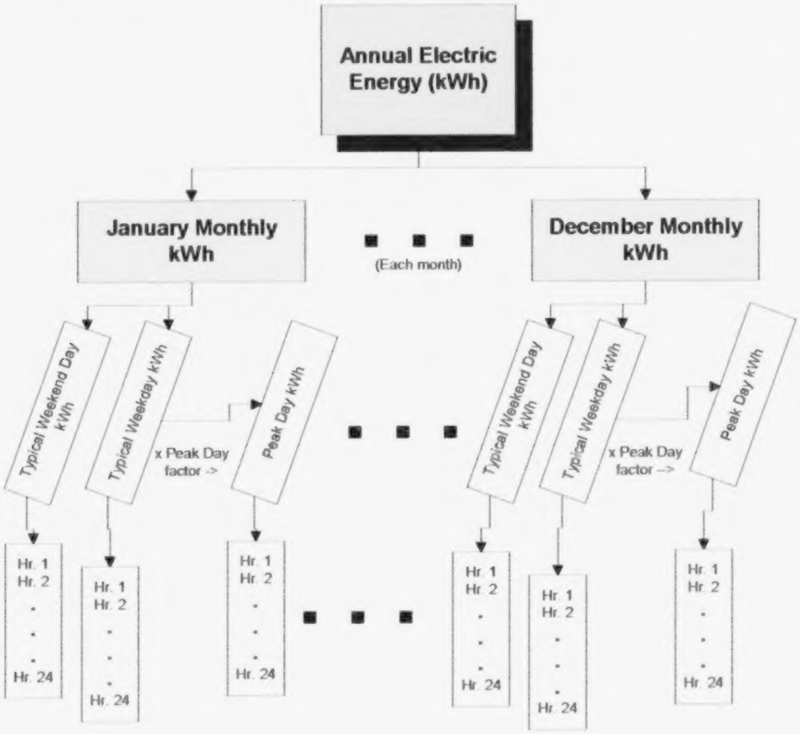
- Heating or cooling degree days applied to an appropriate base.

Weekend to Weekday Factor: This factor is a ratio that describes the relationship between weekends and weekdays, reflecting the degree of weekend activity inherent in the facility or end use. This may vary by month or season. Based on this ratio, the average electric energy per day type can be computed from the corresponding monthly electric energy.

Peak Day Factor: This factor reflects the degree of daily weather sensitivity associated with the load shape, particularly heating or cooling; it compares a peak (e.g., hottest or coldest) day to a typical weekday in that month.

Per Unit Hourly Factor: The relationship of load among different hours of the day for each day type (weekday, weekend day, peak day) and for each month reflects the operating hours of the electric equipment or end use within commercial facilities by sub sector. For example, for lighting, this would be affected by time of day, season (affected by daylight) and business type, where applicable. For the Base Year, lighting is treated on an aggregate basis by total facility.

Exhibit 14 Overview of Peak Load Profile Methodology


Annual Electric Energy (kWh)
January Monthly kWh
(Each month)
December Monthly kWh
Typical Weekend Day kWh
Typical Weekday kWh
x Peak Day factor ->
Peak Day kWh
Typical Weekend Day kWh
Typical Weekday kWh
x Peak Day factor ->
Peak Day kWh
Hr. 1
Hr. 2
Hr. 24

4.4 Summary of Results

The four factors (sets of ratios) defined above provide the basis for converting annual energy to any hourly demand specified including the grouping of hours used in the three peak periods defined in this study. A summary of the Commercial sector results is presented in the next section.

Exhibit 15 presents the model results for the Commercial sector Base Year (2010) aggregate peak demand on the hydro grid, while Exhibit 16 presents results for the three diesel supply regions. The results are presented for the total Yukon service territory, by sub sector. In each case, the results show the contribution of the Commercial sector demand that is coincident with the total Yukon demand in each of the three peak periods selected for this study.

Exhibit 15 Commercial Sector Base Year (2010) Aggregate Electric Peak Demand by Peak Period (MW) – Hydro Grid

Sub Sector	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
Street lighting	0.9	0.7	1.0
Office	4.6	4.0	5.0
Food Retail	1.4	1.4	1.4
Non-food Retail	3.0	2.8	2.3
Hotel / Motel	1.6	1.4	1.5
Healthcare	0.8	0.7	0.8
Education	2.5	2.3	3.2
Recreation Centres	1.2	1.1	1.3
Restaurant	1.4	1.3	1.3
Warehouse / Wholesale	2.8	2.5	3.0
Other General Service Buildings	5.6	4.9	5.9
Non-Buildings	2.2	2.2	2.2
Parking Lot Plug	0.2	0.3	0.0
Grand Total	28.2	25.6	28.9

Exhibit 16 Commercial Sector Base Year (2010) Aggregate Electric Peak Demand by Peak Period (MW) – Diesel Supply Regions

Sub Sector	Large Diesel			Small Diesel			Old Crow		
	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
General Service Buildings	1.10	0.95	0.81	0.30	0.25	0.22	0.13	0.11	0.09
Non-Buildings	0.09	0.09	0.09	0.05	0.05	0.05	0.01	0.01	0.01
Street Lighting	0.06	0.04	0.06	0.02	0.02	0.02	0.01	0.01	0.01
Grand Total	1.25	1.09	0.96	0.37	0.33	0.30	0.15	0.12	0.11

Additional detail is provided in Appendix B, which includes additional information on the methodology, a sample calculation and additional detailed results for the Hydro grid showing both sub sector and end use for each peak period.

5 Reference Case Electric Energy Forecast

5.1 Introduction

This section presents the Commercial sector Reference Case for the study period (2010 to 2030). The Reference Case estimates the expected level of electricity consumption that would occur over the study period in the absence of new utility-based initiatives or rate changes. The Reference Case, therefore, provides the point of comparison for the calculation of electricity savings opportunities associated with each of the subsequent scenarios assessed within this study.

The Reference Case discussion is presented within the following sub sections:

- Methodology
- Summary of model results.

Additional detailed information is provided in Appendix C.

5.2 Methodology

Development of the Reference Case involved the following three steps:

Step 1: Detailed building archetypes were developed for "New" buildings in each of the Commercial sub sectors. For the purposes of this study, any buildings built after the Base Year are considered "New" buildings. Each profile defines building specifications, mechanical equipment, lighting equipment and other electricity-using equipment.

Step 2: Expected "natural" changes in electricity consumption patterns over the study period were estimated. Special consideration was given to three factors:

- Naturally-occurring improvements in equipment efficiency through time

- Expected stock penetration by more efficient equipment as older, inefficient equipment reaches the end of its service life

- Changes in equipment density, e.g., computers and plug loads, etc., or loads, e.g., required ventilation rates.

Step 3: The growth in floor space within each building sub sector over the study period was estimated. The growth rates were derived from the sales forecast data provided by Yukon.

5.3 New Commercial Buildings

The first task in building the Reference Case involved the development of detailed technical profiles that define building specifications, mechanical equipment, lighting equipment and electricity use for the new buildings in each of the commercial building sub sectors. In each case, the new building profiles were developed using CEEAM and the same approach as described previously in described in Section 3.5. Detailed profiles for each existing building sub sector are provided in Appendix C.

Exhibit 17 highlights the resulting whole building electric EUIs for each new commercial building sub sector. For the purposes of comparison, it also shows whole-building electric EUIs for each of the existing building sub sectors. In all cases, whole-building electric EUIs are higher in new buildings compared to corresponding existing buildings. The dominant factor driving these differences is a much higher electric space heating penetration in new buildings compared to existing ones. This assumption is consistent with recent construction practices within the area served by the hydro grid.

Other trends include:

- Higher efficiency building envelopes, including improved window U-values and higher levels of wall and roof insulation. These trends, while observed in other jurisdictions, are particularly apparent in Yukon due to the implementation of the City of Whitehorse *Green Building Standards* in 2009
- Improved lighting system efficiency, including higher efficacy lighting sources and lower light levels where appropriate
- Increased saturation of space cooling in some sub sectors
- Current design guidelines that require higher ventilation rates in selected sub sectors, such as in Education, Food Retail and Health (particularly hospital buildings)
- 100% penetration of artificial ice for ice surfaces contained in new Recreation Centres.

Exhibit 17 Comparison of Whole Building Electric EUIs by Sub Sector, (kWh/ft^2/yr.)

Sub Sector	Existing Buildings	New Buildings	Comments
Office	17.4	21.5	New Office buildings have higher efficiency lighting and envelope systems. This is offset by a higher space cooling saturation and electric space heating share.
Food Retail	51.9	54.9	New Food Retail buildings are typically equipped with higher efficiency lighting, HVAC and envelope systems. This is offset by higher a space cooling saturation and electric space heating share.
Non-food Retail	15.6	19.8	New Non-food retail buildings have higher efficiency lighting and envelope systems. This is offset by a higher space cooling saturation and electric space heating share.
Hotel / Motel	12.6	22.6	New Hotels and Motels have higher efficiency lighting and envelope systems. This is offset by a higher electric space heating share and higher space cooling saturations due primarily to increased instance of in-room heating/cooling units.
Healthcare	22.2	34.6	New healthcare buildings have higher efficiency lighting and envelope systems, and higher space cooling saturation. This is offset somewhat by higher ventilation rates, particularly in larger buildings and a higher electric space heating share.
Education	8.3	12.7	New Schools have higher efficiency lighting and envelope systems. This is offset by a higher electric space heating share.
Restaurant	38.8	44.7	New Restaurants have higher efficiency lighting, and envelope systems. This is offset by a higher electric space heating share.
Recreation Centres	13.5	18.1	Ice Rinks contained within new Rec Centres are assumed to have 100% penetration of artificial ice, with high electric space heating shares in warm areas. This is partially offset by higher efficiency lighting and envelope systems.
Warehouse / Wholesale	10.1	13.9	New Warehouse/Wholesale buildings have higher efficiency lighting and envelope systems. This is offset by a higher electric space heating share.

5.4 "Natural Changes" to Electricity Use Intensity

The next task involved estimating changes in electricity consumption patterns that would occur within the existing building stock over the study period in the absence of any DSM programming or influence. This included consideration of three major factors:

- Naturally-occurring improvements in equipment efficiency
- Expected stock penetration by more efficient equipment
- Changes in the saturation/intensity of end-use services (e.g., cooling, plug loads etc.).

These factors strongly influence future electric energy use within the Commercial sector. While the first two factors will have the effect of reducing electricity consumption, the last factor will result in increased electricity demand. Other considerations, such as operating hours and fuel share, may also affect future electricity demand. However, the values assumed in existing and new stock were assumed to remain constant over the study period.

Based on the assessment of current trends, the most significant natural changes are expected to involve the following end uses:

- Reduced lighting EUIs in existing buildings due to efficiency improvements at the time of natural stock turnover
- A trend toward more efficient space cooling equipment in existing buildings
- Increased computer equipment and plug load EUIs due to higher equipment densities.

Detailed assumptions regarding natural change are presented in Appendix C.

5.5 Commercial Floor Space

The final task in the construction of the Reference Case involved calibration with Yukon's load forecast through time. This was accomplished using the following steps:

- Estimate and apply the expected impact of natural changes (Section 5.4 above) within the existing building stock for each sub sector (i.e., an adjusted EUI that includes the effects of natural conservation at each milestone year)
- Add new buildings to the stock in order to match forecasted consumption in each combination of sub sector and milestone year. This study adds floor area at rates consistent with electricity consumption growth rates presented in the 2011 YEC 20-Year Resource Plan:
    - Hydro grid: 2.26% per year over the course of the study period (all sub sectors)
    - Large Diesel: 0.51%/yr.
    - Small Diesel: 0.13%/yr.
    - Old Crow: 1.71%/yr.

A summary of the resulting floor space estimates in the hydro grid by sub sector and milestone year is provided in Exhibit 18. Exhibit 19 provides floor space estimates in the three diesel grids.

Exhibit 18 Commercial Sector Floor Space, by Sub Sector and Milestone Year – Hydro Region

Sub Sector	Floor Area (ft2)				
	2010	2015	2020	2025	2030
Office	1,364,000	1,541,000	1,742,000	1,968,000	2,224,000
Food Retail	195,000	221,000	250,000	282,000	319,000
Non-food Retail	912,000	1,034,000	1,171,000	1,327,000	1,503,000
Hotel / Motel	618,000	697,000	786,000	886,000	1,000,000
Healthcare	209,000	235,000	264,000	296,000	333,000
Education	1,742,000	1,987,000	2,267,000	2,586,000	2,949,000
Restaurant	195,000	224,000	257,000	295,000	339,000
Recreation Centres	499,000	556,000	619,000	690,000	768,000
Warehouse / Wholesale	1,439,000	1,629,000	1,844,000	2,087,000	2,362,000
Other Gen. Serv. Bldgs.	1,782,000	1,993,000	2,228,000	2,492,000	2,786,000
Grand Total	8,955,000	10,116,000	11,427,000	12,909,000	14,584,000

Note: Any differences in totals are due to rounding.

Exhibit 19 Commercial Sector Floor Space, by Sub Sector and Milestone Year – Diesel Regions

Region	Floor Area (ft2)				
	2010	2015	2020	2025	2030
Large Diesel	464,000	477,000	490,000	504,000	519,000
Small Diesel	118,000	119,000	120,000	121,000	121,000
Old Crow	57,000	63,000	69,000	76,000	83,000
Grand Total	639,000	658,000	679,000	701,000	723,000

Note: Any differences in totals are due to rounding.

5.6 Summary of Model Results

The Reference Case results for the Hydro and Diesel grids are presented in Exhibit 20 and Exhibit 21 respectively. As illustrated, the Reference Case indicates that in the absence of new utility-based DSM initiatives, total Commercial sector electricity consumption is expected to increase from approximately 166 GWh/yr. in the Base Year to approximately 284 GWh/yr. in 2030, an increase of approximately 71%. The hydro region accounts for 157 GWh/yr. and 273 GWh/yr. in 2010 and 2030 respectively.

Exhibit 20 Reference Case Annual Electricity (MWh/yr.) – Hydro Grid

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Office																	
2010	6,006	1,989	-	597	5,637	569	2,680	440	3,783	975	134	141	841	-	-	-	23,792
2015	6,628	2,173	-	675	7,028	731	3,058	540	4,417	1,139	151	159	950	-	-	-	27,650
2020	7,325	2,381	-	763	8,601	912	3,484	653	5,167	1,332	171	180	1,073	-	-	-	32,044
2025	8,107	2,616	-	862	10,378	1,114	3,967	780	6,052	1,561	193	203	1,213	-	-	-	37,046
2030	8,981	2,882	-	974	12,387	1,339	4,511	924	7,094	1,829	218	230	1,371	-	-	-	42,740
Food Retail													-				-
2010	588	579	993	257	547	38	473	101	171	164	121	6,056	50	-	-	-	10,137
2015	648	642	1,101	285	752	48	550	127	200	192	137	6,795	57	-	-	-	11,534
2020	717	714	1,224	316	985	59	636	157	234	224	155	7,630	64	-	-	-	13,115
2025	793	795	1,362	352	1,248	71	734	190	274	263	175	8,574	73	-	-	-	14,904
2030	878	886	1,519	392	1,545	85	845	228	322	308	198	9,641	82	-	-	-	16,929
Non-food Retail													-				-
2010	4,647	2,477	929	799	1,938	152	1,274	134	490	587	236	353	236	-	-	-	14,252
2015	5,070	2,660	1,038	958	2,764	202	1,515	185	574	687	267	400	267	-	-	-	16,587
2020	5,547	2,868	1,162	1,139	3,700	258	1,788	242	673	806	302	453	302	-	-	-	19,240
2025	6,084	3,104	1,302	1,344	4,761	320	2,097	307	790	946	342	514	342	-	-	-	22,253
2030	6,688	3,371	1,461	1,575	5,963	389	2,447	380	929	1,112	388	582	388	-	-	-	25,673
Hotel / Motel													-				-
2010	805	1,443	-	271	2,025	136	912	622	338	305	199	479	221	-	-	-	7,756
2015	882	1,574	-	305	2,680	168	1,029	1,126	391	355	225	540	270	-	-	-	9,545
2020	969	1,722	-	344	3,418	203	1,160	1,694	453	415	254	609	325	-	-	-	11,566
2025	1,066	1,889	-	388	4,251	242	1,308	2,334	527	485	286	686	387	-	-	-	13,850
2030	1,175	2,077	-	438	5,189	286	1,475	3,057	613	567	323	774	457	-	-	-	16,431
Healthcare													-				-
2010	1,165	430	-	183	640	43	1,220	70	232	363	108	81	96	-	-	-	4,630
2015	1,276	456	-	204	995	53	1,405	122	270	421	121	91	107	-	-	-	5,521
2020	1,399	486	-	229	1,394	63	1,612	181	314	490	136	102	121	-	-	-	6,527

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
2025	1,537	519	-	256	1,843	75	1,846	246	366	571	153	115	136	-	-	-	7,662
2030	1,690	557	-	286	2,347	89	2,108	320	426	665	172	129	153	-	-	-	8,941
Education													-				-
2010	3,576	1,413	545	382	2,961	48	1,536	988	1,070	871	450	450	225	-	-	-	14,514
2015	3,953	1,501	618	435	4,549	58	1,752	1,197	1,261	1,026	513	481	257	-	-	-	17,602
2020	4,381	1,602	702	496	6,361	70	1,999	1,435	1,489	1,212	585	517	293	-	-	-	21,141
2025	4,864	1,717	798	566	8,427	83	2,280	1,706	1,761	1,433	667	559	334	-	-	-	25,195
2030	5,411	1,848	907	646	10,785	98	2,601	2,016	2,084	1,696	761	606	381	-	-	-	29,839
Recreation Centres													-				-
2010	480	256	1,793	547	156	3	327	128	25	207	290	2,397	129	-	-	-	6,739
2015	513	269	1,959	609	328	3	355	198	29	239	323	2,635	144	-	-	-	7,605
2020	550	283	2,144	678	520	3	387	277	34	275	360	2,901	160	-	-	-	8,571
2025	591	299	2,350	755	733	4	422	365	39	317	401	3,196	178	-	-	-	9,648
2030	636	317	2,579	841	970	4	460	463	45	366	446	3,525	198	-	-	-	10,849
Restaurant													-				-
2010	431	1,556	-	554	1,147	62	623	331	95	125	816	1,758	50	-	-	-	7,549
2015	483	1,686	-	618	1,383	79	714	595	113	149	938	2,020	58	-	-	-	8,835
2020	542	1,835	-	691	1,654	98	818	898	134	177	1,078	2,322	66	-	-	-	10,315
2025	610	2,007	-	775	1,966	119	939	1,246	160	211	1,239	2,669	76	-	-	-	12,017
2030	687	2,204	-	871	2,325	143	1,077	1,647	191	251	1,424	3,067	88	-	-	-	13,975
Warehouse / Wholesale													-				-
2010	829	681	5,993	630	1,043	6	859	111	658	597	149	2,601	372	-	-	-	14,529
2015	907	745	6,693	713	2,006	7	939	180	770	698	168	2,944	421	-	-	-	17,191
2020	996	817	7,485	808	3,095	8	1,029	258	902	818	190	3,332	476	-	-	-	20,214
2025	1,095	899	8,382	914	4,329	10	1,131	346	1,058	960	216	3,771	539	-	-	-	23,649
2030	1,206	992	9,397	1,035	5,724	12	1,246	445	1,242	1,127	244	4,269	610	-	-	-	27,549
Other General Service													-				-
2010	8,462	3,719	907	1,171	5,434	507	2,995	405	2,950	1,210	314	437	779	-	-	-	29,290

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
2015	9,181	3,987	1,002	1,355	6,978	499	3,429	508	3,409	1,399	351	489	871	-	-	-	33,459
2020	9,981	4,286	1,108	1,562	8,706	492	3,913	623	3,947	1,620	393	546	974	-	-	-	38,150
2025	10,869	4,621	1,227	1,792	10,637	484	4,455	751	4,574	1,877	439	611	1,089	-	-	-	43,427
2030	11,853	4,995	1,360	2,050	12,797	477	5,061	895	5,304	2,177	491	683	1,218	-	-	-	49,361
Non-Buildings													-				-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	19,402	-	-	19,402
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	19,673	-	-	19,673
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	20,619	-	-	20,619
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	22,479	-	-	22,479
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	25,564	-	-	25,564
Street lighting													-				-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,592	-	3,592
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,642	-	3,642
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,817	-	3,817
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,162	-	4,162
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,733	-	4,733
Parking Lot Plug													-				-
2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	340	340
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	345	345
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	361	361
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	394	394
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	448	448
Grand Total													-				-
2010	26,988	14,543	11,160	5,390	21,527	1,564	12,901	3,331	9,814	5,405	2,816	14,752	2,998	19,402	3,592	340	156,523
2015	29,543	15,694	12,412	6,158	29,465	1,848	14,745	4,777	11,434	6,304	3,194	16,554	3,401	19,673	3,642	345	179,189
2020	32,407	16,995	13,825	7,025	38,435	2,166	16,827	6,416	13,347	7,368	3,624	18,593	3,855	20,619	3,817	361	205,680
2025	35,615	18,466	15,421	8,004	48,573	2,523	19,177	8,272	15,601	8,623	4,111	20,898	4,367	22,479	4,162	394	236,686
2030	39,205	20,129	17,222	9,109	60,032	2,922	21,831	10,375	18,250	10,099	4,665	23,506	4,945	25,564	4,733	448	273,033

Note: Results presented are at the customer's point-of-use and do not include line losses.

Exhibit 21 Reference Case Annual Electricity (MWh/yr.) – Diesel Grids

Region / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Large Diesel																	
2010	1,281	768	580	276	41	108	680	219	415	281	154	783	143	826	215	3	6,771
2015	1,287	779	595	284	42	111	701	237	442	299	162	804	147	826	215	3	6,935
2020	1,294	791	609	293	42	114	723	255	470	318	170	826	152	828	215	3	7,105
2025	1,300	804	624	302	43	118	745	274	500	339	178	848	157	831	216	3	7,283
2030	1,307	817	640	312	44	121	768	293	532	361	186	870	161	835	217	3	7,468
Small Diesel																	
2010	325	251	91	79	12	15	194	74	151	70	62	158	47	464	86	4	2,083
2015	320	251	92	79	12	16	195	76	158	73	63	159	47	464	86	4	2,097
2020	316	252	92	80	12	16	197	77	165	77	64	160	48	464	86	4	2,111
2025	312	253	93	81	12	16	198	79	172	80	66	161	48	465	86	4	2,125
2030	307	253	94	81	12	17	200	81	179	83	67	162	48	465	86	4	2,140
Old Crow																	-
2010	192	82	46	28	7	2	85	23	70	36	12	26	19	103	24	-	756
2015	205	86	50	31	7	3	94	27	80	41	14	29	21	103	25	-	814
2020	219	91	54	34	7	3	104	31	90	47	15	31	22	104	25	-	879
2025	234	97	59	38	8	3	116	36	102	53	16	34	25	105	25	-	951
2030	250	103	65	42	9	4	128	41	116	60	18	37	27	107	26	-	1,032

5.7 Selected Highlights

Highlights are provided below.

Hydro Grid

Reference Case Electricity use by End Use

Overall electricity use grows a total of 71% over the study period. This growth is driven in large part by increases in space heating electricity consumption, which grows 179% between 2010 and 2030, due to a large number of new electrically heated buildings being introduced in to the building stock. A knock-on effect of the move toward electric space heating in new buildings is that electricity consumption for water heating also increases dramatically (211%), as electrically heated buildings rarely invest in fossil fuel infrastructure for water heating only.

Three additional end uses grow by more than 85% from 2010 to 2030: space cooling (87%), plug loads (87%) and computer equipment (86%). These end uses are more significant contributors in later milestone years as a result of a trend toward higher space cooling saturations and computer equipment / plug load densities.

End uses which grow at a significantly slower rate than average include architectural lighting (38%) and general lighting (45%). Lighting end uses show a slight decline in importance as more efficient new buildings are introduced into the building stock through time, and as a result of naturally occurring lighting retrofits in existing buildings.

In terms of absolute contribution, space heating accounts for the largest portion of overall load growth (nearly 39,000 MWh, or approximately one-third of total load growth). This is followed by general lighting (10%), HVAC fans & pumps (8%), refrigeration (8%) and computer equipment (7%).

Reference Case Electricity Use by Sub Sector

Reference Case electricity consumption increases at a reasonably similar rate across all sub sectors. In general, electricity use for sub sectors in which space heating constitutes a relatively high portion of electricity use (i.e., Hotel/Motel and Education) show larger increases than average, while sub sectors in which space heating constitutes a relatively small portion of overall energy use (i.e., Recreation Centres and Food Retail) show smaller increases.

Diesel Grids

Reference Case electricity consumption is dictated almost exclusively by growth rates applied for the three diesel regions.

6 Reference Case Electric Peak Load Forecast

6.1 Introduction

This section provides a profile of the electric peak load for Yukon's Commercial sector over the Reference Case period of 2010 to 2030. The Reference Case peak load profile estimates the expected level of demand in each of the three peak periods that would occur over the study period in the absence of new DSM initiatives or rate changes. The Reference Case, therefore, provides the point of comparison for the calculation of peak load savings associated with each of the subsequent scenarios that are assessed within this study.

The discussion is organized into the following sub sections:

- Methodology
- Summary of results.

6.2 Methodology

The electric peak loads for each combination of end use, sub sector and milestone year were calculated in exactly the same manner as shown in Section 4, which presented the Base Year peak load profiles.

For this Reference Case, the electric energy consumption (from Section 5) is converted to a demand value for each of the three peak period definitions by dividing the applicable electric energy value for each building type and end use by the corresponding Commercial sector load shape hours-use factors, as presented in Appendix B.

6.3 Summary of Results

A summary of the Reference Case peak load profiles are presented in Exhibit 22 and Exhibit 23 for the hydro and diesel regions, respectively.

Exhibit 22 Electric Peak Loads, by Milestone Year, Peak Period and Sub Sector (MW) – Hydro Region

Sub Sector	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
Office			
2010	4.6	4.0	5.0
2015	5.3	4.7	5.9
2020	6.2	5.4	7.0
2025	7.2	6.3	8.1
2030	8.3	7.3	9.5
Food Retail			
2010	1.4	1.4	1.4
2015	1.7	1.6	1.6
2020	1.9	1.9	1.9
2025	2.2	2.2	2.2
2030	2.5	2.5	2.5
Non-food Retail			
2010	3.0	2.8	2.3
2015	3.5	3.3	2.9
2020	4.2	3.9	3.5
2025	4.9	4.6	4.2
2030	5.7	5.4	4.9
Hotel / Motel			
2010	1.6	1.4	1.5
2015	1.9	1.7	1.9
2020	2.4	2.1	2.3
2025	2.9	2.5	2.8
2030	3.4	3.0	3.3
Healthcare			
2010	0.8	0.7	0.8
2015	1.0	0.9	1.0
2020	1.2	1.1	1.2
2025	1.4	1.3	1.5
2030	1.7	1.6	1.8
Education			
2010	2.5	2.3	3.2
2015	3.1	2.8	4.1
2020	3.8	3.4	5.2
2025	4.5	4.1	6.5
2030	5.4	4.8	7.9
Recreation Centres			
2010	1.2	1.1	1.3
2015	1.4	1.3	1.5
2020	1.6	1.4	1.7
2025	1.8	1.6	1.9
2030	2.0	1.8	2.2
Restaurant			

Sub Sector	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
2010	1.4	1.3	1.3
2015	1.6	1.5	1.5
2020	1.9	1.8	1.8
2025	2.3	2.1	2.0
2030	2.6	2.4	2.4
Warehouse / Wholesale			
2010	2.8	2.5	3.0
2015	3.4	3.0	3.6
2020	4.0	3.6	4.4
2025	4.8	4.3	5.3
2030	5.6	5.1	6.2
Other General Service			
2010	5.6	4.9	5.9
2015	6.5	5.6	7.0
2020	7.4	6.5	8.1
2025	8.5	7.4	9.4
2030	9.7	8.5	10.9
Non-Buildings			
2010	2.2	2.2	2.2
2015	2.2	2.2	2.2
2020	2.4	2.4	2.4
2025	2.6	2.6	2.6
2030	2.9	2.9	2.9
Street lighting			
2010	0.9	0.7	1.0
2015	0.9	0.8	1.0
2020	1.0	0.8	1.0
2025	1.1	0.9	1.1
2030	1.2	1.0	1.3
Parking Lot Plug			
2010	0.2	0.3	0.0
2015	0.2	0.3	0.0
2020	0.2	0.3	0.0
2025	0.3	0.3	0.0
2030	0.3	0.4	0.0
Grand Total			
2010	28.2	25.6	28.9
2015	32.8	29.8	34.3
2020	38.1	34.6	40.5
2025	44.2	40.2	47.6
2030	51.4	46.7	55.8

Exhibit 23 Electric Peak Loads, by Milestone Year, Peak Period and Sub Sector (MW) – Diesel Regions

Sub Sector / Milestone Year	Large Diesel			Small Diesel			Old Crow		
	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
General Service Buildings									
2010	1.10	0.95	0.81	0.30	0.26	0.22	0.13	0.11	0.09
2015	1.14	0.97	0.83	0.30	0.26	0.22	0.14	0.12	0.10
2020	1.17	1.00	0.86	0.30	0.26	0.23	0.15	0.13	0.11
2025	1.20	1.03	0.88	0.31	0.26	0.23	0.17	0.14	0.12
2030	1.23	1.06	0.91	0.31	0.27	0.23	0.18	0.15	0.13
Non-Buildings									
2010	0.09	0.09	0.09	0.05	0.05	0.05	0.01	0.01	0.01
2015	0.09	0.09	0.09	0.05	0.05	0.05	0.01	0.01	0.01
2020	0.09	0.09	0.09	0.05	0.05	0.05	0.01	0.01	0.01
2025	0.10	0.10	0.10	0.05	0.05	0.05	0.01	0.01	0.01
2030	0.10	0.10	0.10	0.05	0.05	0.05	0.01	0.01	0.01
Street lighting									
2010	0.06	0.04	0.06	0.02	0.02	0.02	0.01	0.01	0.01
2015	0.06	0.04	0.06	0.02	0.02	0.02	0.01	0.01	0.01
2020	0.06	0.04	0.06	0.02	0.02	0.02	0.01	0.01	0.01
2025	0.06	0.05	0.06	0.02	0.02	0.02	0.01	0.01	0.01
2030	0.06	0.05	0.06	0.02	0.02	0.02	0.01	0.01	0.01
Grand Total									
2010	1.25	1.09	0.96	0.37	0.33	0.30	0.15	0.12	0.11
2015	1.29	1.11	0.99	0.38	0.33	0.30	0.16	0.13	0.12
2020	1.32	1.14	1.01	0.38	0.33	0.30	0.17	0.15	0.13
2025	1.35	1.17	1.04	0.38	0.33	0.30	0.18	0.16	0.14
2030	1.39	1.20	1.06	0.38	0.34	0.31	0.20	0.17	0.15

Selected highlights include:

- Consistent with electricity consumption trends, those sub sectors in which space heating constitutes a relatively high portion of electricity use (i.e., Hotel/Motel and Education) show larger increases than average in contribution toward peak load, while sub sectors in which space heating constitutes a relatively small portion of overall energy use (i.e., Recreation Centres and Food Retail) show smaller increases. This trend is more highly evident for peak demand as compared to electricity consumption, as space heating load is highly coincident with the defined peak periods.

- Notwithstanding the above, peak demand contributions for specific sub sectors are largely expected to follow the electricity consumption trends for those sub sectors as the hours-use factors applied are held constant over the study period. Offices, for example, will continue to make the largest commercial contribution to peak demand for all three demand periods, throughout the study period.

- Similarly, peak demand contributions for specific end uses are expected to follow the electricity consumption trends for those end uses. Space heating becomes an increasingly important contributor to peak demand through time, while indoor lighting, because of natural gains in efficiency, will make a gradually declining contribution towards the peak demand.

7 Technology Assessment: Energy-efficiency Measures

7.1 Introduction

This section identifies and assesses the economic attractiveness of the selected energy-efficiency technology measures for the Commercial sector. The discussion is organized and presented as follows:

- Methodology
- Energy-efficiency technologies
- Summary of "unbundled" results
- Energy-efficiency supply curves.

7.2 Methodology

The following steps were employed to assess the energy-efficiency measures:

- Select candidate energy-efficiency measures
- Establish technical performance for each option
- Establish the capital, installation and operating costs for each option
- Calculate the cost of conserved energy (CCE) for each measure.

A brief description of each step is provided below.

Step 1 Select Candidate Measures

The candidate measures were selected in close collaboration with client personnel based on a combination of a literature review and previous study team experience. The selected measures are all considered to be technically proven and commercially available, even if only at an early stage of market entry. Technology costs, which will be addressed in this section, were not a factor in the initial selection of candidate technologies.

Step 2 Establish Technical Performance

Information on the performance improvements provided by each measure was compiled from available secondary sources, including the experience and on-going research work of study team members.

Step 3 Establish Capital, Installation and Operating Costs for Each Measure

Information on the cost of implementing each measure was also compiled from secondary sources, including the experience and on-going research work of study team members.

The incremental cost is applicable when a measure is installed in a new facility, or at the end of its useful life in an existing facility; in this case, incremental cost is defined as the cost difference for the energy-efficiency measure relative to the baseline technology. The full cost is applicable when an operating piece of equipment is replaced with a more efficient model prior to the end of its useful life.[16]

In both cases, the costs and savings are annualized, based on the number of years of equipment life and the discount rate, and the costs incorporate applicable changes in annual O&M costs. All costs are expressed in constant 2010 dollars.

Step 4 Calculate CCE for Each Measure

One of the important sets of information provided in this section is the CCE associated with each energy-efficiency measure. The CCE for an energy-efficiency measure is defined as the annualized incremental cost of the upgrade measure divided by the annual energy savings achieved, excluding any administrative or program costs required to achieve full use of the technology or measure. All cost information presented in this section and in the accompanying measure TRC model are expressed in constant 2010 dollars.

The CCE provides a basis for the subsequent selection of measures to be included in the Economic Potential Forecast (see Section 8). The CCE is calculated according to the following formula:

$$\frac{C_A + M}{S}$$

Where:

C_A is the annualized installed cost
M is the incremental annual cost of operation and maintenance (O&M)
S is the annual kWh energy savings

And *A* is the annualization factor

$$A = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where:

i is the discount rate
n is the life of the measure

The detailed CCE tables (see measure TRC model) show both "incremental" and "full" installed costs for the energy-efficiency measures, as applicable. If the measure or technology is installed in a new facility, or at the point of natural replacement in an existing facility, then the incremental cost of the measure versus the cost of the baseline technology is used. If, prior to the end of its life, an operating piece of equipment is replaced with a more efficient model, then the full cost of the efficient measure is used.

---

[16] With some exceptions, many measures could conceivably be applied as either a full-cost measure (applicable immediately) or as an incremental cost measure (upon end of service life), depending on how financially attractive it is. Therefore, for all but a few measures, the TRC model is configured to evaluate the measure at full cost and include it on that basis if it passes the screen, then roll to evaluating it on an incremental basis, and only fail it completely if it fails both tests. Where a measure is always full cost (such as a roof insulation upgrade, where the baseline technology is the "do nothing" option), the incremental cost option is excluded. Where a measure is always incremental cost (such as high-performance new construction, where the baseline technology has to be a standard construction home, not no home at all), the full cost option is excluded.

It is recognized that some measures can be implemented prior to the end of their useful life, that is, early retirement. This intermediate option between full and incremental cost could increase the rate of adoption for some of the incremental measures, raising the Economic Potential savings modestly. However, in this study early retirement is treated as a program option.

The annual saving associated with the efficiency measure is the difference in annual electricity consumption with and without the measure.
The CCE calculation is sensitive to the chosen discount rate. In the CCE calculations that accompany this document, a discount rate of 5.25% (real) is used.

Step 5 Estimate Approximate “Unbundled” Energy Savings Potential for Each Measure

The next step in the assessment was to prepare an approximate estimate of the potential “unbundled” energy savings that could theoretically be provided by each measure over the study period. The term “unbundled” means that the savings for each measure are calculated in isolation of other important factors that ultimately determine the potential for real life savings.

The strength of this approach is that it provides insight into the relative size of the potential energy savings associated with individual measures; this perspective is often of particular value to utility DSM program design personnel who may need to consider combinations of energy-efficiency measures that differ from those selected for the CPR analysis.

However, it should be noted that the savings from individual measures cannot be used directly to calculate total savings potential. This is due primarily to two factors:

- More than one upgrade may affect a given end use. For example, improved insulation reduces space heating electricity use, as does the installation of new energy-efficient windows. On its own, each measure will reduce overall space heating electricity use. However, the two savings are not additive. The order in which some upgrades are introduced is also important. In this study, the approach has been to select and model the impact of “bundles of measures” that reduce the load for a given end use (e.g., wall insulation and glazing upgrades that reduce the space heating load) and then to introduce measures that meet the remaining load more efficiently (e.g., a high-efficiency space heating system).

- There are interactive effects among end uses. For example, the electricity savings from more efficient appliances and lighting result in reduced waste heat. During the space heating season, lighting waste heat contributes to the building’s internal heat gains, which lower the amount of heat that must be provided by the space heating system. The magnitude of the interactive effects can be significant. Based on selected residential building energy-use simulations, a 100 kWh savings in appliance or lighting electricity use results, on average, in an increased space heating load of 59 kWh to 66 kWh, depending on housing detachment type, vintage and geographical location.

The above factors are incorporated in later stages of the analysis.

Step 6 Prepare Energy-efficiency Supply Curves

The final step in the assessment of the selected energy-efficiency measures was the generation of a set of energy-efficiency supply curves. Supply curves are built up based on the conserved electricity and the CCE for each measure. CSEEM was used to model the application of all technically feasible measures, accumulating the electricity savings and associated implementation costs for each sub sector. Measures were applied sequentially to account, at least approximately, for interaction between measures.

The accumulated savings and costs for each measure were added together to present the overall supply curve for the territory. They were sorted in order from lowest cost per kWh saved to highest cost, and presented on a graph showing CCE versus electricity savings.

7.3 Energy-efficiency Technology Assessment

Exhibit 24 shows the energy-efficiency technologies and measures that are included in this study. A description and detailed financial and economic assessment of each measure is provided in the measure TRC model that accompanies this report.

Exhibit 24 Energy-efficiency Technologies Included in this Study

Lighting
- Standard T8 systems (T12 Baseline)
- High-performance T8 systems – retrofit
- High-performance T8 systems - redesign
- Occupancy controls
- Dimming controls (daylighting)
- Compact fluorescent lamps
- White LED lamps
- Halogen infrared lamps
- Ceramic metal halide lamps
- Pulse-start metal halide systems
- T5 high-intensity fluorescent systems

Outdoor Lighting
- Compact fluorescent lamps – outdoor
- Pulse-start metal halide systems – outdoor
- Outdoor lighting controls
- Induction lamps
- Digital HID street lighting
- LED street lighting

Building Envelope
- High-performance glazing
- Super high-performance glazing
- Wall insulation upgrade
- Roof insulation upgrade
- Air sealing

Water Heating
- Ultra low-flow faucet aerators
- Ultra low-flow showerheads
- Low-flow pre-rinse spray valves
- Tank insulation
- Drainwater heat recovery

Cooking
- High-efficiency cooking equipment

Refrigeration

- ENERGY STAR® refrigerators and freezers
- Efficient refrigeration – full-cost measures
- Efficient refrigeration –incremental cost measures

HVAC
- Ground-source heat pumps
- Cold climate air-source heat pumps
- Solar pre-heat makeup air
- Infrared/radiant heaters
- High-volume low-speed destratification fans
- Air-to-air heat recovery
- HE chillers
- HE packaged DX cooling
- Demand-controlled ventilation
- Demand-controlled kitchen ventilation
- Adjustable speed drives
- Premium efficiency motors
- Programmable thermostats

Computer Equipment and Plug Loads
- ENERGY STAR® computers
- ENERGY STAR® office equipment
- Energy-efficient server technologies
- Block heater controls

Whole Building Measures
- Recommissioning

New Buildings
- New – 25% better than current design practice
- New – 40% better than current design practice
- New – 60% better than current design practice

Recreation Centre Measures

- Low-emissivity ceilings
- Brine pump – VSD or two-speed motor
- Heat recovery
- Refrigeration plant controls
- High output T5 lighting

7.3.1 Technology Screening Results

A summary of the results is provided in Exhibit 25. For each of the measures, the exhibit shows:

- The name of the measure
- The cost basis[17] for the CCE that is shown, e.g., full versus incremental
- The measure's average CCE when applied to all sub sectors.

Measures analyzed on the basis of full cost have been placed towards the top of Exhibit 25 because they are qualitatively different from the measures that pass only on an incremental basis. A measure that passes on a full-cost basis can be applied immediately, even if the piece of equipment it replaces or improves is currently working properly. That means the rate at which the measure can be implemented as a utility DSM measure is limited by market and program constraints. A measure that passes only on an incremental basis, on the other hand, is limited by the rate of natural replacement (due to failure or obsolescence) or purchase of the piece of equipment it replaces.

Exhibit 25 Commercial Sector Energy-efficiency Technology Measures, Screening Results[18] - Hydro Region

Measure Name	Basis (Full/[19] Incremental)	Average CCE (¢/kWh)
Low-flow Faucets	Full	0.09
Lighting Controls (Outdoor)	Full	0.42
Demand-Controlled Kitchen Ventilation	Full	0.73
Low-flow Showerheads	Full	0.89
Domestic Hot Water Tank Insulation	Full	1.88
Brine Pump Control	Full	2.02
High-performance T8 (Redesign)	Full	2.05
Air Sealing	Full	2.40
Adjustable Speed Drive (Fan Application)	Full	2.64
High-Volume Low-Speed Destratification Fans	Full	2.72
Demand-Controlled Ventilation	Full	2.86
Building Recommissioning	Full	2.95
High-performance T8 (T12 Retrofit)	Full	3.34
Pulse Start Metal Halide Lamps	Full	3.72
Pulse Start Metal Halide Lamps (Outdoor)	Full	3.78
CFL Lamps (Indoor)	Full	3.87
CFL Lamps (Outdoor)	Full	3.87
Block Heater Controls	Full	3.93
Low-flow Pre-rinse Spray Valves	Full	4.05
Air-to-Air Heat Recovery	Full	4.22
T8 Fluorescent Lamps (T12 Baseline)	Full	4.65
Occupancy Controls	Full	5.11
Drainwater Heat Recovery	Full	5.71
White LED Lamps	Full	5.89
Ceramic Metal Halide Lamps	Full	6.24

---

[17] See Step 3 in Section 7.2 for a complete description.

[18] Average CCE does not include program costs.

[19] Due to the high avoided cost of new supply in Yukon many measures pass at full cost. The CCEs for energy-efficient equipment upgrades at time of failure (incremental) are typically significantly lower.

Measure Name	Basis (Full/[19] Incremental)	Average CCE (¢/kWh)
Roof Insulation Upgrade	Full	6.55
Ground-Source Heat Pump	Full	6.70
Wall Insulation Upgrade	Full	7.81
Programmable Thermostats	Full	9.46
Refrigeration Plant Controls	Full	9.80
Digital HID Street Lighting	Full	9.99
High-Performance T8 (T8 Retrofit)	Full	11.03
High-Efficiency Refrigeration Equipment - Full Cost Measures	Full	11.83
Refrigeration Plant Heat Recovery	Full	17.71
Dimming Controls (Daylighting)	Full	19.66
Premium Efficiency Motors	Full	19.83
T5 High Output Fluorescent Systems	Full	21.71
ENERGY STAR® Office Equipment	Full	23.49
ENERGY STAR® Servers	Full	23.49
Induction Lamps (Outdoor)	Full	25.09
LED Street Lighting	Full	25.10
T5 High Output Arena Lighting	Full	25.68
Halogen IR Lamps	Full	28.78
Infrared Electric Radiant Heaters	Full	28.80
ENERGY STAR® Computers	Full	36.83
Low-Emissivity Ceiling	Full	37.69
New Building Construction - 25% Better than Current Practice	Incr.	2.44
High-Performance Glazing	Incr.	3.25
New Building Construction - 40% Better than Current Practice	Incr.	4.57
Super High-performance Glazing	Incr.	6.24
ENERGY STAR® Refrigerators and Freezers	Incr.	7.50
New Building Construction - 60% Better than Current Practice	Incr.	10.16
High-Efficiency Cooking Equipment	Incr.	11.50
High-Efficiency Refrigeration Equipment - Incremental Cost Measures	Incr.	14.71
High-Efficiency Chillers	Incr.	63.17
High-Efficiency Packaged Direct-Expansion (DX) Cooling	Incr.	107.31
Low-Temperature Air-Source Heat Pump[20]	Full	N/A
Solar Pre-Heated Makeup Air	Full	N/A

7.4 Energy-efficiency Supply Curves

A supply curve was constructed based on the approximate Technical Potential savings associated with the above measures. The following approach was used:

- Measures were introduced in sequence
- Where more than one measure affected the same end use, the savings shown for the second measure are incremental to those already shown for the first

---

[20] The results of preliminary analysis of the measures "Low-Temperature Air Source Heat Pumps" and "Solar Pre-Heated Makeup Air" indicated that these technologies are not widely applicable in the Yukon climate. These measures were not considered further.

- Sequence was determined by listing first the items that reduce the electrical load, then those that meet residual load with the most efficient technology. It includes consideration of CCE results from the preceding exhibit

- Items appear in order, starting with the lowest average CCE, but do not stop at a specified CCE level. Hence, it presents a type of Technical Potential scenario.

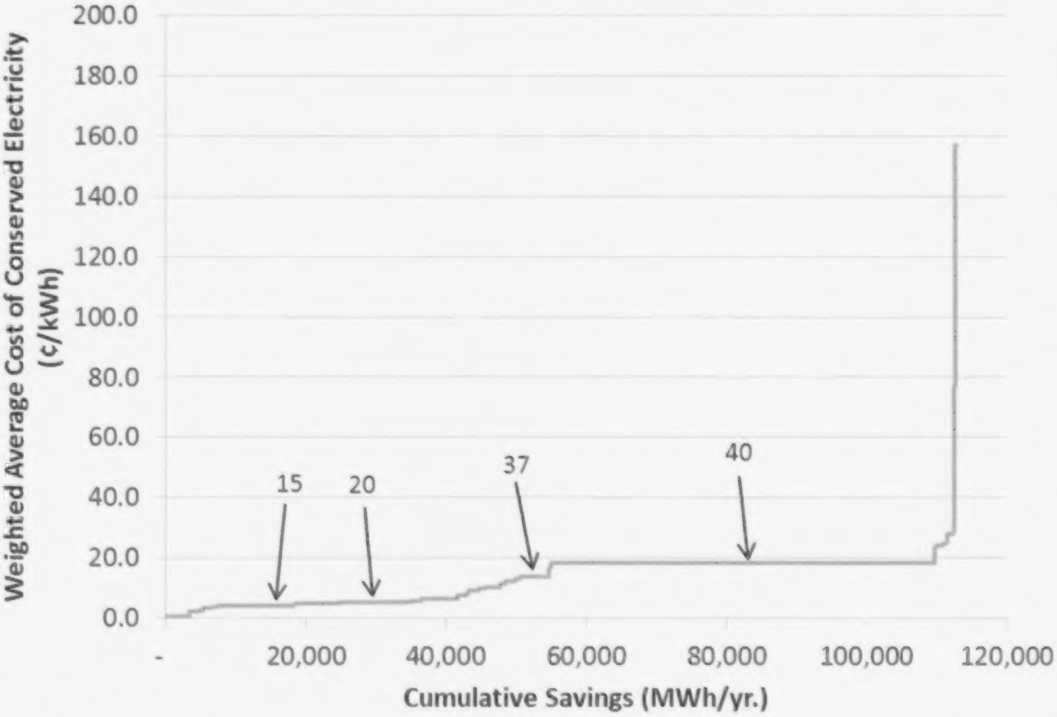
Exhibit 26 shows the measures included in the supply curve and Exhibit 27 shows the supply curve. Selected reference numbers in the left hand column of Exhibit 26 have been placed on the supply curve as landmarks.

Exhibit 26 Summary of Commercial Sector Energy-efficiency Measures, 2030

Ref #	Measure	Technical Potential Savings (MWh/yr.)	Accumulated CCE ($)	Weighted Average CCE (¢/kWh)
1	Low-flow Faucets	1,126	4,350	0.4
2	Lighting Controls (Outdoor)	2,048	8697	0.4
3	Demand Controlled Kitchen Ventilation	166	1,199	0.7
4	Brine Pump Control	1,365	26,387	1.9
5	CFL to LED increment	447	10,937	2.4
6	Low-flow Pre-rinse Spray Valves	118	2,892	2.5
7	High Volume Low Speed Fans	38	1031	2.7
8	Adjustable Speed Drives (Fans)	1,346	42,374	3.1
9	Air Sealing	775	26,788	3.5
10	Tank Insulation	101	3,817	3.8
11	Pulse Start MH	2,010	76,976	3.8
12	Pulse Start MH (Outdoor)	788	30,362	3.9
13	CFL Lamps (Outdoor)	579	22,629	3.9
14	Block Heater Controls	313	12,363	4.0
15	CFL Lamps (Indoor)	7,061	279,185	4.0
16	Drainwater Heat Recovery	99	3,992	4.0
17	ENERGY STAR® Computers	4,608	220,804	4.8
18	High Efficiency Refrigeration - Full Cost	1,846	91,730	5.0
19	Demand Controlled Ventilation	442	22,814	5.2
20	Building Recommissioning	8,334	430,234	5.2
21	High Performance T8 to Redesign increment	1,242	65,510	5.3
22	Air-to-air Heat Recovery	1,474	79,664	5.4
23	High Efficiency Refrigeration - Incremental Cost	2,553	157,738	6.2
24	Occupancy Controls	596	38174	6.4
25	High Performance Glazing	2,257	146,602	6.5
26	Low-flow Showerheads	245	17,949	7.3
27	ENERGY STAR® Fridges, Freezers	759	58,104	7.7
28	ENERGY STAR® Office Equipment	376	30,296	8.1
29	Ground Source Heat Pump	916	80,984	8.8
30	Digital High Intensity Discharge to LED Streetlighting increment	565	51198	9.1
31	Refrigeration Plant Controls (Rec. Centre)	58	5,426	9.4
32	ENERGY STAR® Servers	934	92,072	9.9
33	Digital High Intensity Discharge Streetlighting	2,238	225,350	10.1

Ref #	Measure	Technical Potential Savings (MWh/yr.)	Accumulated CCE ($)	Weighted Average CCE (¢/kWh)
34	High Performance to Super High Performance Glazing increment	605	69,566	11.5
35	Wall Insulation	1,241	151,897	12.2
36	Roof Insulation	818	104,931	12.8
37	High Performance T8 (T8 Retrofit)	4,212	579,869	13.8
38	Pulse Start Metal Halide to T5 High Output increment	101	16,392	16.2
39	High Efficiency Cooking Equipment	255	43,905	17.2
40	Whole Building - 60% More Efficient than Current	54,591	9,914,427	18.2
41	Premium Efficiency Motors	179	41,295	23.1
42	Dimming Controls (Daylighting)	1,104	266,814	24.2
43	T5 High Output Recreation Centre Lighting	485	119,739	24.7
44	Induction Lighting (Outdoor)	60	15,158	25.2
45	Programmable Thermostat	920	258,209	28.1
46	Infrared Heating	100	28,665	28.6
47	Low E Ceiling (Recreation Centre)	58	20,871	36.1
48	High Efficiency Chillers	74	57,029	76.9
49	High Efficiency DX Cooling	237	371,537	156.9
	TOTAL	112,865	14,428,933	12.8

Exhibit 27 Supply Curve - Commercial Sector, 2030



8 Economic Potential: Electric Energy Forecast

8.1 Introduction

This section presents the Commercial sector Economic Potential Forecast for electric energy for the study period 2010 to 2030. The Economic Potential Forecast estimates the level of electricity consumption that would occur if all equipment and building envelopes were upgraded to the level that is cost effective against the economic threshold values for electricity in the four supply system areas in Yukon. In this study, "cost effective" means that the technology upgrade cost, referred to as the cost of conserved energy (CCE) in the preceding section, is equal to or less than the economic threshold value for a given supply system.

The discussion in this section covers the following:

- Avoided cost used for screening
- Major modelling tasks
- Technologies included in Economic Potential Forecast
- Presentation of results
- Interpretation of results
- Energy-efficiency supply curves
- Summary of peak load reductions.

Additional information is provided in Appendix F.

8.2 Avoided Cost Used For Screening

YECL, YEC and the Government of Yukon agreed on a set of economic threshold values for electricity supply to be used in this study. The values vary by supply system, as follows:

- General Service accounts on the hydro grid: $0.35/kWh
- General Service accounts on large diesel and small diesel systems: $0.30/kWh
- General Service accounts on the Old Crow system: $0.64/kWh.

The Economic Potential Forecast then incorporates all the electric energy-efficient upgrades that the technology assessment found to have a CCE equal to or less than these thresholds.

The purpose for establishing these thresholds as the economic cut-off values for new avoided electrical supply is to provide the CPR study with a reasonably useful time horizon (life) to allow planners to examine options that may become more cost effective over time.

Emerging end-use technology measures tend to become cheaper over time as production scales up and becomes more cost effective. This is apparent by examining a range of measures that have become very low cost (e.g., CFLs reduced by a factor of 5-10x since introduction; the same applies to more efficient motors, light sources and appliances). Including these apparently more costly measures in this study allows the review of these measures in the near future.

In addition, electrical supply costs rise as more expensive generating sources are used to lower the carbon content of electricity either through the use of new fossil fuel technologies, such as carbon capture and storage (CCS), or the use of renewable (e.g., wind) or alternative energy sources (e.g., combined heat and power [CHP]).

8.3 Major Modelling Tasks

By comparing the results of the Commercial sector Economic Potential Electric Energy Forecast with the Reference Case, it is possible to determine the aggregate level of potential electricity savings within the Commercial sector, as well as identify which specific building sub sectors and end uses provide the most significant opportunities for savings.

To develop the Commercial sector Economic Potential Forecast, the following tasks were completed:

- The CCE for each of the energy-efficient upgrades presented in Exhibit 25 were reviewed, using the 5.25% (real) discount rate.
- Technology upgrades that had a CCE equal to, or less than, the threshold values for each supply system were selected for inclusion in the Economic Potential scenario, either on a full-cost or incremental basis. It is assumed that technical upgrades having a full-cost CCE that met the cost threshold were implemented in the first forecast year. It is assumed that those upgrades that only met the cost threshold on an incremental basis are being introduced more slowly as the existing stock reaches the end of its useful life.
- Electricity use within each of the building sub sectors was modelled with the same energy models that were used to generate the Reference Case. However, for this forecast, the remaining baseline technologies included in the Reference Case forecast were replaced with the most efficient technology upgrade option and associated performance efficiency that met the cost thresholds for each supply system.
- When more than one upgrade option was applied to a given end use, the first measure selected was the one that reduced the electrical load. For example, measures to reduce the overall DHW load (e.g., low-flow showerheads and pre-rinse spray valves) were applied before DHW tank insulation.

8.4 Technologies Included in Economic Potential Forecast

Exhibit 28 provides a listing of the technologies selected for inclusion in this forecast. In each case, the exhibit shows the following:

- End use affected
- Upgrade option(s) selected
- Rate at which the upgrade options were introduced into the stock.

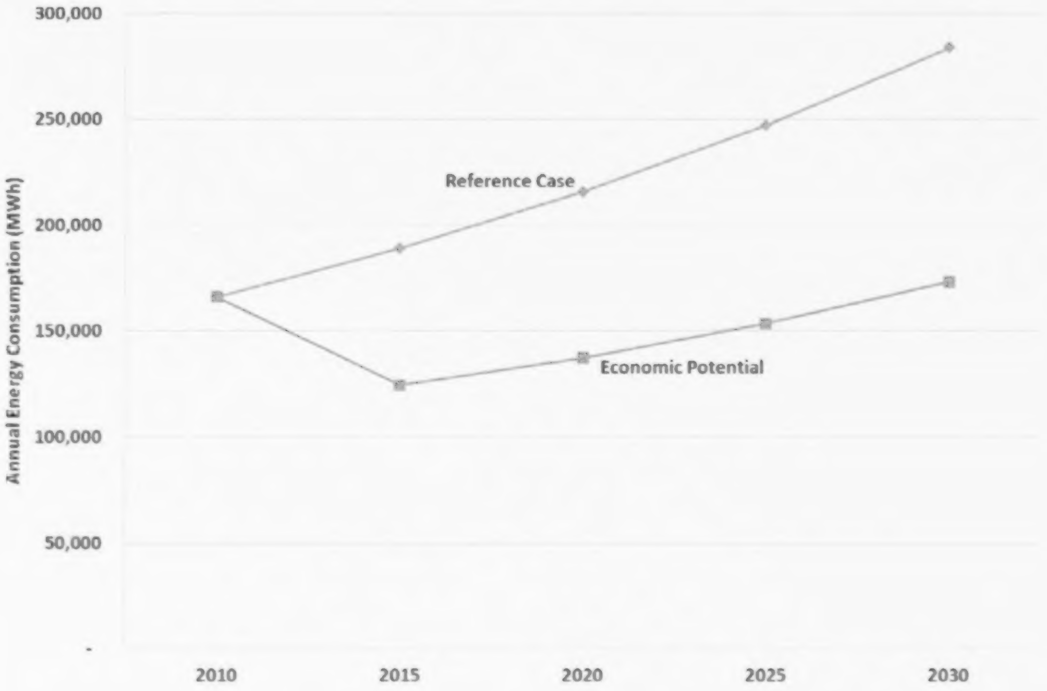
Exhibit 28 Technologies Included in Economic Potential Forecast

End Use / Application	Upgrade Option	Rate of Stock Introduction
General lighting	Reduced wattage T8	Immediate
	Lighting redesign w/ RWT8	Immediate
	Occupancy controls	Immediate
	Dimming controls/ daylighting	Immediate
Architectural lighting	CFL lamps (Indoor)	Immediate
	White LEDs	Immediate
Outdoor lighting	Pulse start metal halide (outdoor)	Immediate
	CFL lamps (outdoor)	Immediate
	Lighting controls (outdoor)	Immediate
Computer equipment	ENERGY STAR® PCs	Immediate
	ENERGY STAR® office equipment	Immediate
	ENERGY STAR® servers	Immediate
Cooking	High-efficiency cooking equipment	At rate of stock replacement
Refrigeration	ENERGY STAR® refrigerators and freezers	At rate of stock replacement
	High-efficiency refrigeration – full-cost measures	Immediate
	High-efficiency refrigeration – incremental cost measures	At rate of stock replacement/refit
	Refrigeration plant controls (Recreation Centres only)	Immediate
Building envelope	High-performance windows	At rate of replacement/ major building refit
	Wall insulation	At rate of replacement/ major building refit
	Roof insulation	At time of roof replacement
	Air sealing	Immediate
Space heating	Programmable thermostat (Small Buildings only)	Immediate
	Air-to-air heat recovery	Immediate
	Demand controlled ventilation	Immediate
	Demand controlled kitchen ventilation Restaurant only)	Immediate
	Ground-source heat pump	Immediate
	Infrared radiant heating (Warehouse/Wholesale only)	Immediate
	High-volume low-speed destratification fans (Warehouse/Wholesale only)	Immediate
Space cooling	No space cooling - specific measures pass economic screen	
HVAC fans & pumps	Fan adjustable speed drives	Immediate
	Premium efficiency motors	At time of motor replacement
Water heating	Low-flow fixtures	Immediate
	Low-flow pre-rinse spray valves	Immediate
	DHW tank insulation	Immediate
	Drainwater heat recovery	Immediate
	Ice plant heat recovery (Ice Rink only)	Immediate
Streetlighting	Digital HID streetlight ballasts	Immediate
High-bay lighting	Pulse start metal halide	Immediate
	T5 HO	Immediate
Parking lot plug	Block heater controls	Immediate
Whole building	Recommissioning	Immediate
Whole building -new building design	New buildings – 60% better	Immediate

8.5 Summary of Electric Energy Savings

Exhibit 29 compares the Reference Case and Economic Potential Electric Energy Forecast levels of commercial electricity consumption.[21] As illustrated, under the Reference Case commercial electricity use would grow from the Base Year level of 166,000 MWh/yr. to approximately 284,000 MWh/yr. by 2030. This contrasts with the Economic Potential Forecast in which electricity use would increase to approximately 173,000 MWh/yr. for the same period, a difference of approximately 110,000 MWh/yr., or about 39%.

Exhibit 29 Reference Case versus Economic Potential Electric Energy Consumption in Commercial Sector (MWh/yr.)



---

[21] All results are reported at the customer's point-of-use and do not include line losses.

8.5.1 Electric Energy Savings

Further detail on the total potential electric energy savings provided by the Economic Potential Forecast is provided in the following exhibits. Full results by end use, milestone year and subsector are provided in Appendix F:[22]

- Exhibit 30 presents Economic Potential savings by end use, service region and milestone year.
- Exhibit 31 presents Economic Potential savings for the sub sector, service region and milestone year.
- Exhibit 32 presents savings by major end use and milestone year
- Exhibit 33 presents savings by sub sector and vintage
- Exhibit 34 presents savings distribution by end use and region.

---

[22] MWh/yr. savings shown in the following exhibits are not incremental. For example, the space heating savings in 2030 are not in addition to the space heating savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the Economic Potential scenario are implemented.

Exhibit 30 Economic Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.)

Region	Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Street Lighting	Block Heater	Total
Hydro Grid	2015	14,036	8,722	4,394	3,676	12,889	375	3,896	2,806	3,522	116	80	4,910	2,016	88	61,526
	2020	14,808	9,459	5,230	4,165	18,665	577	5,073	3,772	4,114	136	182	6,817	2,113	92	75,204
	2025	15,721	10,291	6,170	4,718	25,087	802	6,401	4,866	4,813	159	208	8,589	2,304	101	90,229
	2030	17,209	11,233	7,231	5,342	32,242	1,053	7,903	6,106	5,633	187	237	9,894	2,620	114	107,004
Large Diesel	2015	605	443	200	173	16	14	153	138	138	5	3	220	119	1	2,228
	2020	575	450	209	178	18	17	166	149	147	6	5	283	119	1	2,323
	2025	537	457	218	183	20	20	180	160	157	6	6	332	120	1	2,395
	2030	516	465	227	189	22	23	193	171	167	6	6	349	120	1	2,455
Small Diesel	2015	149	143	30	48	5	2	40	43	49	2	2	32	47	1	594
	2020	138	144	30	49	5	2	41	44	51	2	3	44	47	1	603
	2025	125	144	31	49	6	3	42	45	53	2	4	52	47	1	603
	2030	116	144	31	49	6	3	43	46	56	2	4	54	48	1	603
Old Crow	2015	97	48	17	18	3	0	23	16	25	1	0	2	14	-	264
	2020	100	51	20	20	3	1	29	18	28	1	1	4	14	-	289
	2025	102	54	23	22	4	1	35	21	32	1	1	5	14	-	314
	2030	108	57	26	25	4	1	42	24	36	1	1	5	14	-	345
Total	2015	14887	9357	4641	3916	12913	392	4112	3002	3734	124	85	5165	2196	90	64,612
	2020	15621	10103	5489	4412	18692	597	5309	3982	4341	144	192	7149	2294	94	78,419
	2025	16484	10947	6441	4972	25116	825	6659	5092	5055	168	218	8978	2485	103	93,542
	2030	17949	11899	7514	5604	32274	1079	8181	6347	5892	196	248	10303	2802	116	110,406

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) In the above exhibit a value displays as 0 if it is between 0 and 0.5. Totals are calculated using the actual numerical value.
4) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumptio ı 2030 and the space heating consumption if all the measures included in the Economic Potential scenario are implemented.

Exhibit 31 Economic Potential Electricity Savings by End Use and Milestone Year (MWh/yr.)

Sub Sector	2015	2020	2025	2030
Office	11,415	13,637	16,116	19,012
Food Retail	4,429	5,959	7,593	8,882
Non-food Retail	7,362	8,758	10,287	12,095
Hotel / Motel	4,010	5,191	6,451	7,876
Healthcare	2,145	2,674	3,254	3,921
Education	7,419	9,345	11,459	13,918
Recreation Centres	3,443	3,962	4,537	5,185
Restaurant	3,529	4,590	5,692	6,818
Warehouse / Wholesale	5,464	6,912	8,543	10,402
Other General Service Buildings	10,207	11,971	13,894	16,160
Street lighting	2,196	2,294	2,485	2,802
Parking Lot Plug	90	94	103	116
General Service Buildings - Diesel Regions	2,904	3,033	3,130	3,218
Total	64,612	78,419	93,542	110,406

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) In the above exhibit a value displays as 0 if it is between 0 and 0.5. Totals are calculated using the actual numerical value.
4) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the Economic Potential scenario are implemented.

Exhibit 32 Economic Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.)

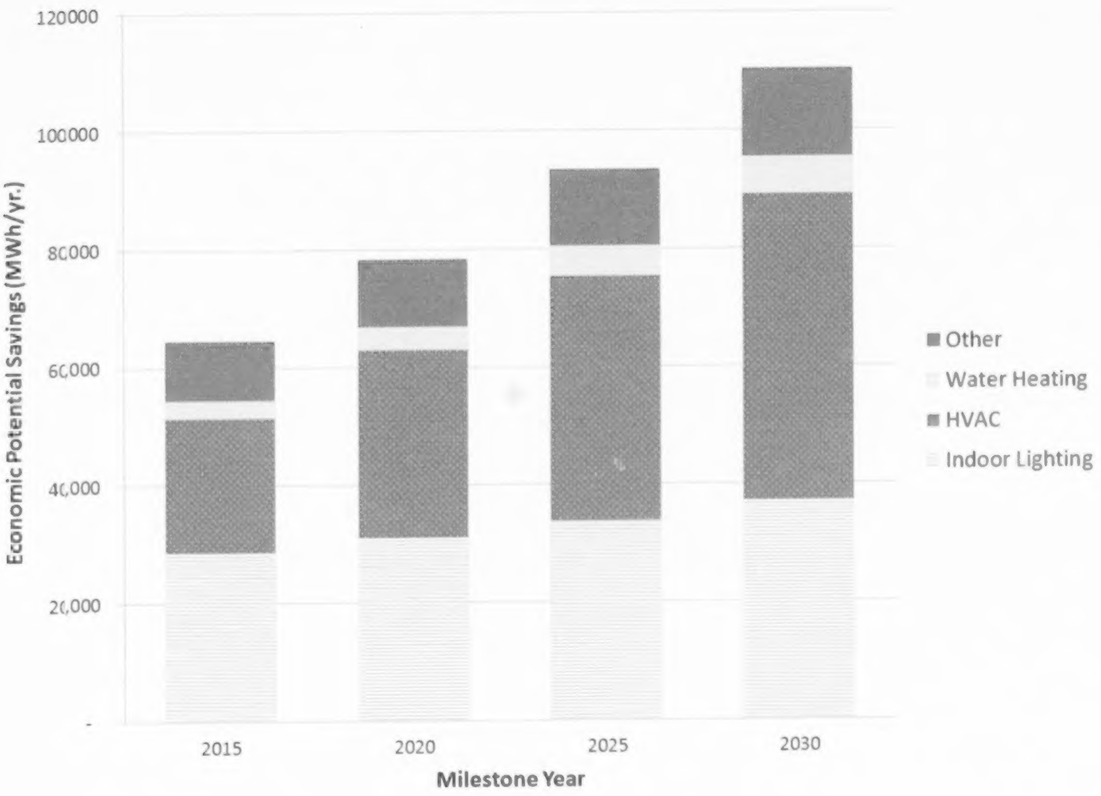


Exhibit 33 Economic Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.)

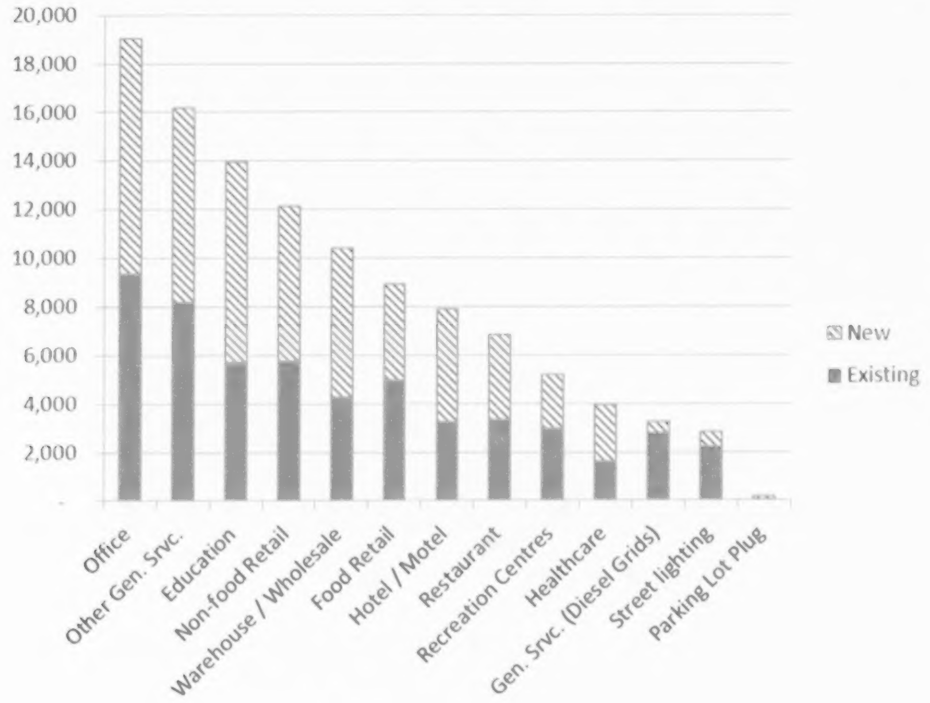
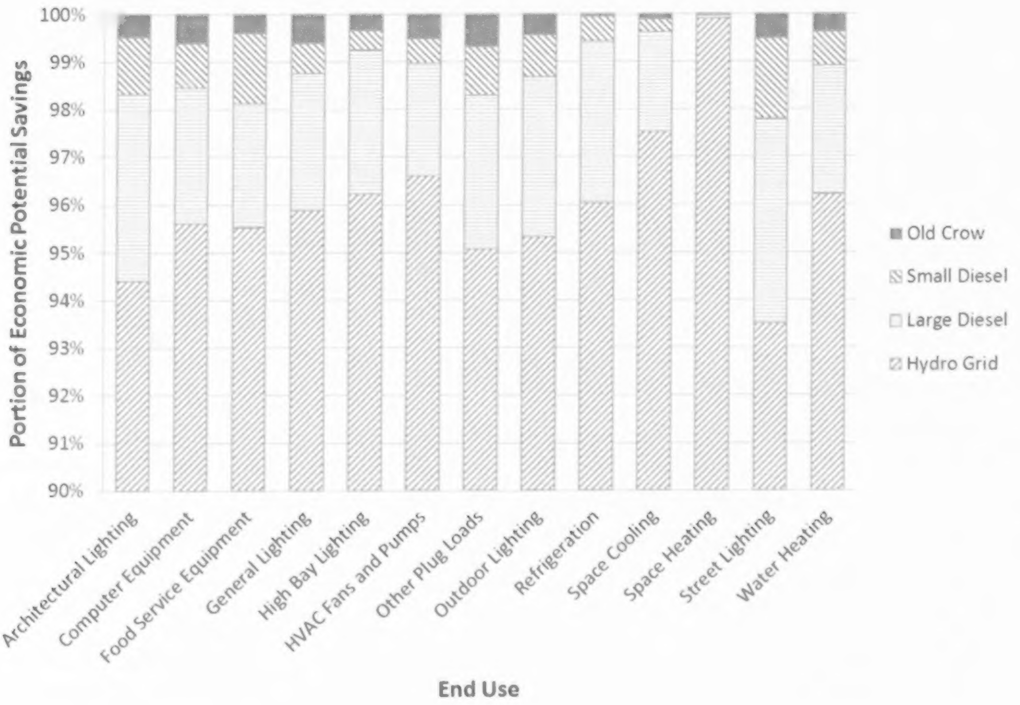


Exhibit 34 Economic Potential Savings Distribution by Major End Use and Region - 2030 (%)



8.6 Interpretation of Results

Highlights of the results presented in the preceding exhibits are summarized below:

Electric Energy Savings by Milestone Year

- The Economic Potential savings increase from 65,000 MWh/yr. in 2015 to 110,000 MWh/yr. in 2030. Approximately 59% of the savings possible at the end of the study period are already economically viable within the first milestone period.
- Space heating savings are more heavily "back loaded" than typical, with only 40% of 2030 savings possible within the first milestone period. This occurs because a large portion of space heating savings result from high-performance new construction measures.
- End uses that have many full-cost measures immediately applied show savings that are more heavily "front loaded" than is typical. The lighting end uses are notable in this regard, specifically general lighting (83% of savings possible within the first milestone period), architectural lighting (79%), outdoor lighting (70%) and street lighting (78%).
- In addition to front-loaded savings, the Reference Case integrates incoming efficiency standards for linear fluorescent and general service lighting. This has a limiting effect on the Economic Potential savings in the general lighting and architectural lighting end uses in later milestone years.

Electric Energy Savings by Sub Sector

- Offices account for approximately 17% of Economic Potential savings, followed by Other General Service Buildings (15%), Education (13%) and Non-food retail (11%). This is primarily a reflection of the large share of commercial electricity consumed in these sub sectors, although sub sectors with high space heating electricity use relative total electricity use tend to have relatively higher Economic Potential savings.
- In addition, the Office and Non-food retail sub sectors consume a large portion of their electricity in indoor lighting end uses. These end uses have high savings in the Economic Potential scenario, ranging from 36% to 60% of 2030 Reference Case consumption, leading to higher overall savings in these sub sectors.

By Supply Type and Government versus Non-government Accounts

- Buildings on the hydro grid account for approximately 97% of potential savings in 2030. Buildings on the large diesel grid account for 2%, while buildings in the small diesel and Old Crow regions account for less than 1%.
- Because measures are screened based only on CCE, which takes into account avoided utility cost, but not customer rates, measures are applied to Government and Non-government sub sectors identically in the Economic Potential scenario. Government and non-government accounts have identical savings percentages by sub sector in the Economic Potential scenario.

By Existing versus New Construction

- As outlined in Exhibit 33, savings in existing buildings account for 49% of potential savings in 2030, while savings in buildings that are expected to be built during the study period account for 51% of potential savings. High savings levels in new buildings are a result of the combination of aggressive conservation measures applied to new construction, relatively high rates of new construction, and high new building electricity use intensity (driven by high electric space heating fuel shares).

Electric Energy Savings by End Use

- As shown in Exhibit 32, savings from HVAC and indoor lighting end uses make up the majority of savings in each of the milestone years. In 2030, HVAC end uses make up 47% of 2030 savings, dominated by space heating (29%) and HVAC fans and pumps (7%), while indoor lighting end uses account for 34% of Economic Potential savings (general lighting 16%, architectural lighting 11% and high-bay lighting 7%).
- Exhibit 34 shows a large regional variance in the composition of savings by end use, with space heating (and to a lesser extent space cooling) savings under-represented in the diesel grid regions.

8.6.1 Caveats on Interpretation of Results

A systems approach was used to model the energy impacts of the efficiency upgrades presented in the preceding section. In the absence of a systems approach, there would be double counting of savings and an accurate assessment of the total contribution of the energy-efficient upgrades would not be possible. More specifically, there are two particularly important considerations:

- More than one upgrade may affect a given end use. For example, improved insulation reduces space heating electricity use, as does the installation of a heat pump. On its own, each measure will reduce overall space heating electricity use. However, the two savings are not additive. The order in which some upgrades are introduced is also important. In this study, the approach has been to select and model the impact of "bundles of measures" that reduce the load for a given end use (e.g., wall insulation and window upgrades that reduce the space heating load) and then to introduce measures that meet the remaining load more efficiently (e.g., a high-efficiency space heating system).
- There are interactive effects among end uses. For example, the electricity savings from more efficient appliances and lighting result in reduced waste heat. During the space heating season, appliance and lighting waste heat contributes to the building's internal heat gains, which lower the amount of heat that must be provided by the space heating system. The magnitude of the interactive effects can be significant.

8.7 Energy-efficiency Supply Curves

A supply curve was constructed based on the approximate Economic Potential savings associated with the above measures. The following approach was followed:

- Measures are introduced in sequence to show incremental impact and cost

- Sequence was determined by listing first the items that reduce the electrical load, then those that meet residual load with the most efficient technology
- Items appear in order, beginning with those that have the lowest average CCE.

Exhibit 35 shows the measures included in the supply curve and Exhibit 36 shows the supply curve for Yukon as a whole in the 2030 milestone year. The annual savings shown for measures in this section will, in most cases, differ from the savings amounts shown in Exhibit 26:

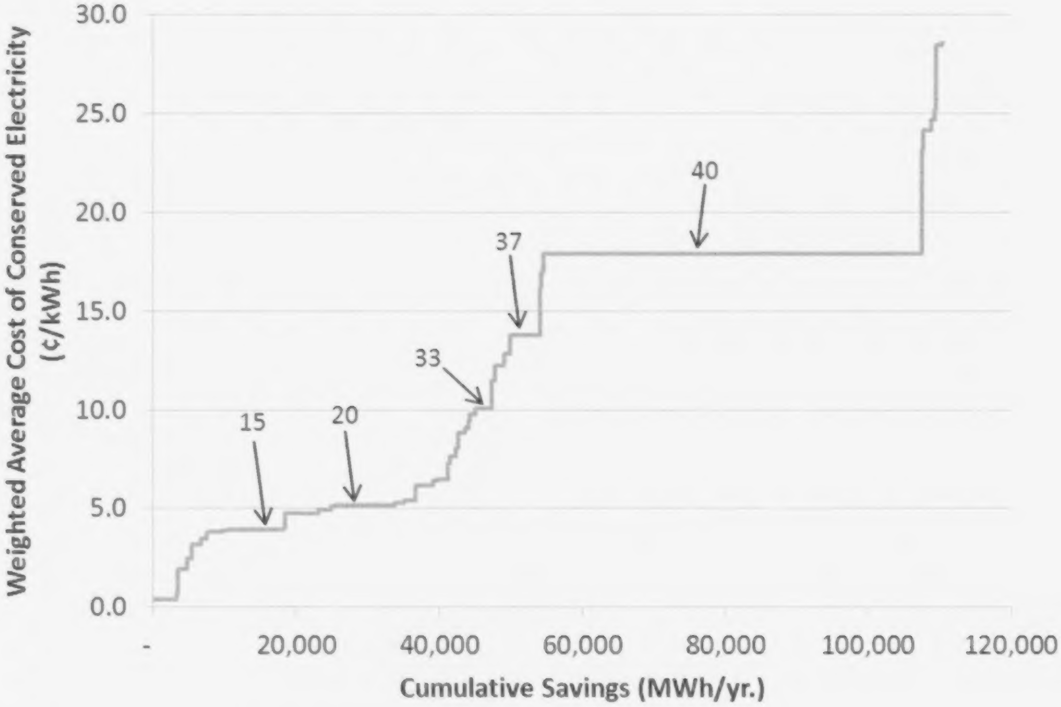
- In most cases, values are reduced by the economic screens applied. If they fail to pass the screen for specific sub sectors or regions, or if measures pass on an incremental basis instead of a full-cost basis the savings will be reduced. Some measures are eliminated entirely.
- Values that increase in Exhibit 35 do so because other measures applied to the same end use fail the economic screen, leaving more consumption available to be saved by subsequently applied measures. For example, air-to-air heat recovery has a total savings of 1,474 MWh/yr. in the Technical Potential Scenario and 1,548 MWh/yr. in the Economic Potential scenario, where space heating saving envelope measures are applied less broadly.

Exhibit 35 Summary of Commercial Sector Energy-efficiency Measures, 2030

Ref #	Measure	Economic Potential Savings (MWh/yr.)	Cost of Savings ($)	Weighted Average CCE (c/kWh)
1	Low-flow Faucets	1,126	4,350	0.4
2	Lighting Controls (Outdoor)	2,048	8,697	0.4
3	Demand Controlled Kitchen Ventilation	175	1,264	0.7
4	Brine Pump Control	1,365	26,387	1.9
5	CFL to LED increment	447	10,937	2.4
6	Low-flow Pre-rinse Spray Valves	118	2,892	2.5
7	High Volume Low Speed Fans	40	1,087	2.7
8	Adjustable Speed Drives (Fans)	1,346	42,374	3.1
9	Air Sealing	814	28,123	3.5
10	Tank Insulation	101	3,817	3.8
11	Pulse Start MH	2,010	76,976	3.8
12	Pulse Start MH (Outdoor)	788	30,362	3.9
13	CFL Lamps (Outdoor)	579	22,629	3.9
14	Block Heater Controls	313	12,363	4.0
15	CFL Lamps (Indoor)	7,061	279,185	4.0
16	Drainwater Heat Recovery	99	3,992	4.0
17	ENERGY STAR® Computers	4608	220804	4.8
18	High Efficiency Refrigeration - Full Cost	1,846	91,730	5.0
19	Demand Controlled Ventilation	464	23,887	5.1
20	Building Recommissioning	8,446	435,063	5.2

Ref #	Measure	Economic Potential Savings (MWh/yr.)	Cost of Savings ($)	Weighted Average CCE (c/kWh)
21	High Performance T8 to Redesign increment	1,242	65,510	5.3
22	Air-to-air Heat Recovery	1,548	83,545	5.4
23	High Efficiency Refrigeration - Incremental Cost	2,553	157,738	6.2
24	Occupancy Controls	597	38,213	6.4
25	High Performance Glazing	1,505	97,735	6.5
26	Low-flow Showerheads	245	17,949	7.3
27	ENERGY STAR® Fridges, Freezers	759	58104	7.7
28	ENERGY STAR® Office Equipment	376	30,296	8.1
29	Ground Source Heat Pump	964	85,232	8.8
30	Digital High Intensity Discharge to LED Streetlighting increment	565	51,180	9.1
31	Refrigeration Plant Controls (Rec. Centre)	58	5,426	9.4
32	ENERGY STAR® Servers	908	89,039	9.8
33	Digital High Intensity Discharge Streetlighting	2,238	225,306	10.1
34	High Performance to Super High Performance Glazing increment	420	48,210	11.5
35	Wall Insulation	1,306	159,725	12.2
36	Roof Insulation	862	110,369	12.8
37	High Performance T8 (T8 Retrofit)	4,212	579,869	13.8
38	Pulse Start Metal Halide to T5 High Output increment	101	16392	16.2
39	High Efficiency Cooking Equipment	248	42,135	17.0
40	Whole Building - 60% More Efficient than Current	53,045	9,489,591	17.9
41	Premium Efficiency Motors	179	41,295	23.1
42	Dimming Controls (Daylighting)	1,104	266,814	24.2
43	T5 High Output Recreation Centre Lighting	485	119739	24.7
44	Induction Lighting (Outdoor)	60	15,158	25.2
45	Programmable Thermostat	**928**	**264,055**	**28.5**
46	Infrared Heating	**106**	**30215**	**28.6**
	Total	110,406	13,515,759	12.2

Exhibit 36 Energy-efficiency Supply Curve, Commercial Sector, 2030



8.8 Summary of Electric Peak Load Reductions

Exhibit 37 and Exhibit 38 present a summary of the peak load reductions that would occur as a result of the electric energy savings contained in Economic Potential Forecast for the hydro and diesel regions respectively. The reductions are shown by milestone year and peak period. In each case, the reductions are an average value over the peak period and are defined relative to the Reference Case presented previously in Section 4 and Section 6.

Note that Exhibit 37 and Exhibit 38 only approximate the potential demand impacts associated with the energy-efficiency measures, as they are based on the assumption that the measures do not change the load shape of the end uses they affect.

Exhibit 37 Electric Peak Load Reductions from Economic Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector – Hydro Grid (MW)

Sub Sector	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
Office			
2010	-	-	-
2015	2.3	2.0	2.5
2020	2.7	2.4	3.1
2025	3.2	2.8	3.7
2030	3.8	3.3	4.5
Food Retail			
2010	-	-	-
2015	0.7	0.6	0.6
2020	0.9	0.9	0.9
2025	1.1	1.1	1.1
2030	1.3	1.3	1.3
Non-food Retail			
2010	-	-	-
2015	1.6	1.5	1.3
2020	1.9	1.9	1.6
2025	2.3	2.2	2.0
2030	2.8	2.7	2.5
Hotel / Motel			
2010	-	-	-
2015	0.8	0.7	0.8
2020	1.1	1.0	1.0
2025	1.4	1.2	1.3
2030	1.7	1.5	1.6
Healthcare			
2010	-	-	-
2015	0.4	0.4	0.4
2020	0.5	0.5	0.5
2025	0.6	0.6	0.6
2030	0.8	0.7	0.8
Education			
2010	-	-	-
2015	1.3	1.2	1.8
2020	1.7	1.5	2.4
2025	2.1	1.9	3.1
2030	2.5	2.3	3.9
Recreation Centres			
2010	-	-	-
2015	0.6	0.6	0.6
2020	0.7	0.7	0.7
2025	0.9	0.8	0.8

Sub Sector	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
2030	1.0	0.9	1.0
Restaurant			
2010	-	-	-
2015	0.7	0.6	0.6
2020	0.9	0.8	0.8
2025	1.1	1.0	1.0
2030	1.3	1.2	1.2
Warehouse / Wholesale			
2010	-	-	-
2015	1.2	1.1	1.2
2020	1.5	1.4	1.6
2025	1.9	1.7	2.1
2030	2.3	2.1	2.6
Other General Service			
2010	-	-	-
2015	2.0	1.8	2.1
2020	2.4	2.1	2.6
2025	2.8	2.5	3.1
2030	3.3	2.9	3.7
Non-Buildings			
2010	-	-	-
2015	-	-	-
2020	-	-	-
2025	-	-	-
2030	-	-	-
Street lighting			
2010	-	-	-
2015	0.5	0.4	0.5
2020	0.5	0.4	0.6
2025	0.6	0.5	0.6
2030	0.7	0.5	0.7
Parking Lot Plug			
2010	-	-	-
2015	0.1	0.1	0.0
2020	0.1	0.1	0.0
2025	0.1	0.1	0.0
2030	0.1	0.1	0.0
Grand Total			
2010	0.0	0.0	0.0
2015	12.1	11.0	12.5
2020	14.9	13.5	15.9
2025	18.0	16.4	19.6
2030	21.5	19.6	23.8

Exhibit 38 Electric Peak Load Reductions from Economic Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector – Diesel Grids (kW)

Sub Sector / Milestone Year	Large Diesel			Small Diesel			Old Crow		
	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
General Service Buildings									
2010	-	-	-	-	-	-	-	-	-
2015	420	358	303	109	93	80	52	44	37
2020	434	372	316	110	94	81	57	48	40
2025	444	382	325	109	94	82	62	53	44
2030	455	391	334	109	94	82	69	58	48
Non-Buildings									
2010	-	-	-	-	-	-	-	-	-
2015	0	0	0	0	0	0	-	-	-
2020	0	0	0	0	0	0	-	-	-
2025	0	0	0	0	0	0	-	-	-
2030	0	0	0	0	0	0	-	-	-
Street lighting									
2010	-	-	-	-	-	-	-	-	-
2015	30	25	32	12	10	13	3	3	4
2020	31	25	32	12	10	13	4	3	4
2025	31	25	33	12	10	13	4	3	4
2030	31	25	33	12	10	13	4	3	4
Grand Total									
2010	-	-	-	-	-	-	-	-	-
2015	451	383	335	121	103	93	56	47	40
2020	465	397	348	122	104	94	61	51	44
2025	475	407	358	121	104	95	66	56	48
2030	485	416	367	121	104	95	72	61	52

9 Technology Assessment: Peak Load Measures

9.1 Introduction

This section identifies and assesses the economic attractiveness of selected Commercial sector electric capacity-only peak load reduction measures, which in this study are defined as those measures that affect electric peak but have minimal or no impact on daily, seasonal or annual energy use. The discussion is organized and presented as follows:

- Methodology
- Electric peak load reduction measures
- Summary of results.

9.2 Methodology

The following steps were employed to assess the peak load reduction measures:

- Select candidate peak load reduction measures
- Establish technical performance for each option
- Establish the capital, installation and operating costs for each option
- Calculate the cost of electric peak load reduction (CEPR) for each option.

A brief description of each step is provided below. Additional information is provided in Appendix G.

Step 1 Select Candidate Measures

The candidate measures were selected in close collaboration with YEC, YECL and Government of Yukon personnel based on a combination of a literature review and previous study team experience. The selected measures are all considered to be technically proven and commercially available, even if only at an early stage of market entry. Technology costs, which will be addressed in this section, were not a factor in the initial selection of candidate technologies.

Step 2 Establish Technical Performance

Information on the performance improvements provided by each measure was compiled from available secondary sources, including documented experience and on-going research work by other utilities and study team members. In some cases, comfort may be affected and the trade-off between benefits (e.g., cost savings) and costs (including reduction in comfort) were judged based on past experience with similar technologies and customer acceptance.

Step 3 Establish Capital, Installation and Operating Costs for Each Measure

Information on the cost of implementing each measure was also compiled from secondary sources, including the experience and on-going research work of study team members.

Unlike energy-efficiency measures, in which major equipment, such as heating and water heating systems are typically replaced, or thermal envelope measures such as insulation upgrades affect systems directly, capacity-only measures are typically implemented via add-on control equipment, although some built-in control equipment exists. The incremental cost is thus defined as the control equipment itself or incremental cost for a controllable appliance or device relative to the baseline appliance cost (e.g., remote-accessible thermostat vs. standard thermostat), plus any required infrastructure (e.g., automatic meter reading or communications gateways). In cases where a more efficient appliance with peak control functions replaces a standard appliance, both energy and electric peak reduction are achieved, with some splitting of incremental costs attributable to each function. In cases where a new or replacement end use is installed that operates off-peak, thus achieving electric peak reduction without significant energy impacts, incremental costs for the electric peak reduction device will be compared with standard equipment without assuming any early replacement and, thus, salvage value.

In all cases, the costs and savings are annualized, based on the number of years of equipment life and the discount rate, and the costs incorporate applicable changes in annual O&M costs. All costs are expressed in constant (2010) dollars.

Step 4 Calculate CEPR for Each Measure

The CEPR for a peak load reduction measure is defined as the annualized incremental cost of the measure divided by the annual peak reduction achieved, excluding any administrative or program costs required to achieve full use of the technology or measure. All cost information presented in this section and in the accompanying tables (see Appendix G) is in constant (2011) dollars.

The CEPR provides a basis for the comparison of peak load measures with the costs of new system capacity. The CEPR is calculated according to the following formula:

$$\frac{C_A + M}{S_p}$$

Where:

C_A is the annualized installed cost
M is the incremental annual cost of operation and maintenance (O&M)
S_p is the annual kW load reduction associated with peak definition p.

And A is the annualization factor.

$$A = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where:

i is the discount rate; n is the life of the measure.

Note that the annual O&M cost will include, in some cases, amortized costs associated with infrastructure considered a prerequisite for implementation of the measure. This could include automated metering infrastructure (AMI), such as advanced metering, communications gateways and other related system investments. These costs would typically support multiple applications (e.g., communications gateways could enable control of heating, air conditioning, water heating, pool pumps, spas and small appliances), as well as facilitate time-differentiated rates that would be required for a feasible and cost-effective program implementation (e.g., thermal energy storage). It should also be noted that the measure lifetime is for the control device, function or feature, rather than that of the unit it is controlling. The study does not presume any specific technology or infrastructure, but does assume that a marketplace will develop for such systems, whether or not Yukon utilities adopt them, or develops access directly or indirectly to customer control equipment.Where applicable, the lifetimes used are taken from Yukon sources.

The CEPR can be compared to benefits, which include the value of reduced peak for the utility (avoided capacity and transmission and distribution [T&D] investment or purchase costs), the customer (e.g., bill savings) and society (e.g., value of environmental benefits) to determine its cost effectiveness from various perspectives (societal, utility, participant and non-participant).

As with the CCE for energy savings, the CEPR calculation is sensitive to the chosen discount rate, which, as for the CCE, used a 5.25% (real) discount rate. Higher discount rates will tend to reduce savings and decrease cost effectiveness where costs are incurred upfront and benefits accrue over many years.

9.2.1 Electric Peak Reduction Measures

The selected electric peak load reduction measures are presented in Exhibit 39.[23] It should be noted that some measures included in the exhibit could be implemented as behavioural measures in the short term, until—and if—the technology to automate these measures becomes cost effective. For example:

- A utility program that appeals to business customers to conserve on a particular day or span of hours could be implemented as a volunteer behavioural measure by occupants or building management. This action could involve shutting off unnecessary lights as an O&M measure by operating remote switches for that purpose.
- Wireless or power line carrier (building wiring) communications systems currently exist to automate or shut pre-selected building loads remotely within buildings with the cooperation of tenants and building owners and management (where separate).
- Finally, utility access, via communications with building EMS or other automated systems could enable utilities to shut devices, with customer approval, remotely during system critical times, much as is often done with remote thermostat control systems for heating and cooling now in use by many utilities.

---

[23] A full description of each measure is provided in Appendix G.

Exhibit 39 Summary of Commercial Sector Electric Peak Load Reduction Measures

End Use	Capacity-only Measure	Description	Applicability of Measures By Sub sector
Water heating	Switch-based water heating unit control	Control switch installed on water heating system circuits or unit for remote shut off or cycling control (typically utility controlled)	Electric water heating with separate tanks
Engine block heaters	Switch-based timer control	Remote control switch activated by utilities to force unit operation (with or without timers) to avoid 4-8 pm system peak period. Timers could be used to lock out these times from use and would still provide sufficient time for block heat. Rechargeable battery-based block heaters could also be provided that would be charged during off-peak hours and discharged during the evening hours	For commercial fleets and maintenance vehicles often plugged in at the end of the work day
Lighting	Non-essential lighting control	Control switch installed on non-essential lighting plug loads and circuits (e.g., holiday lights, segmented partially-controlled secondary lighting areas like stairwells, outdoor lighting, and signage) for utility control during system critical events; can override locally	All, including offices with windows during daylight events, unoccupied hotel/lodging rooms, hallway lighting (at predetermined shutdown level such as 50% of hallway light circuits)
Multiple (whole-facility)	Voluntary remote plug load control for office equipment	Switches on voluntary, non-essential plug loads or enable sleep mode for utility control during system critical events (e.g., peripherals, copiers) remotely controlled with plug switches – can be locally overridden	All customers
	Voluntary remote circuit control	Switches on voluntary non-essential circuits for redundant systems, such as elevators, non-spoilage refrigeration (beverages).	All customers with applicable equipment Multiple elevator buildings
Space heating	Electric thermal storage (ETS)	ETS room units to replace electric supplemental units	Hotels, Restaurants, electrically heated offices
	Switch-based heating unit load control	Control switch installed on heating system circuits for room units based on occupancy	

9.2.2 Technology Screening Results

A summary of the results is provided in Exhibit 40. For each of the measures reviewed, the exhibit shows:

- The name of the measure
- The cost basis for the CEPR shown, e.g., full versus incremental

- The measure's average CEPR.

Measures analyzed on the basis of full cost have been placed towards the top of Exhibit 40 as they are qualitatively different from the measures that pass only on an incremental basis. A measure that passes on a full-cost basis can be applied immediately, while incremental measures presume the adoption of other technologies as a condition of their cost effectiveness (e.g., facility network gateways).

Exhibit 40 Commercial Sector Capacity Reduction Measures, Screening Results

Measure Name	Basis (Full/Incremental)	CEPR Ranges ($/kW)
Engine block heater switch-timer	Full	$33 - $42
Lighting switch load control	Full	$26 - $28
Multiple whole facility elevator/HVAC switches	Full	$38
Electric heat switch control for Hotels	Full	$56 - $63
Electric water heater control switches	Full	$48 - $55
Multiple whole facility refrigeration switches	Full	$53
Multiple whole facility plug load switches	Full	$30 - $41
Electric thermal storage room units	Full	$132 - $147
Multiple whole facility elevator/HVAC switches	Incremental	$23 - $28
Electric heat switch control for Hotels	Incremental	$42 - $47
Multiple whole facility refrigeration switches	Incremental	$39
Electric water heater control switches	Incremental	$35 - $40
Multiple whole facility plug load switches	Incremental	$17 - $23

9.3 Electric Peak Supply Curves

A supply curve was constructed based on the approximate Economic Potential savings associated with the above measures. The following approach was followed:

- Measures are introduced in sequence to show incremental impact and cost
- Sequence was determined by listing first the items that reduce the electrical peak, then those that meet residual load with the most efficient technology
- Items appear in order, beginning with those that have the lowest average CEPR.

Exhibit 41 shows the measures included in the supply curve. Exhibit 42 and Exhibit 43 show the supply curves under two scenarios: with and without existing gateways.

Note that since there was no threshold established for maximum cost effective CEPR, all measures are listed and there are no exclusions based on cost effectiveness.

Exhibit 41 Economic Potential Electric Capacity measures and MW Impact

Electric Peak Reduction Measures	Applicable Count 2010	Avg. kW/unit	Avg kW	Avg CEPR $/kW/yr.
Space Heating				
One-way switch for engine block heater - utility load control – stand-alone (assumes 10,000 units)	1,333	0.17 – 0.22	259	$33 - $42
Electric thermal storage (10% of Hotel/Health Offices)	672	0.74 – 0.82	523	$132 - $147
One-way switch for control (Hotels) – stand alone	67	5.15 – 5.77	366	$56 - $63
One-way switch for control (Hotels) - incremental	67	5.15 – 5.77	366	$42 - $47
Electric Water Heating				
One-way switch-based utility load control – stand alone	391	0.50 – 0.57	209	$48 - $55
One-way switch-based utility load control – incremental	391	0.50 – 0.57	209	$35 - $40
Lighting				
One-way switch-based utility load control – stand alone	1,166	1.60 – 1.77	1,967	$26 - $28
One-way switch-based utility load control - incremental	1,166	1.60 – 1.77	1,967	$19 - $21
Plug Loads				
One-way switch-based utility load control – stand alone	709	0.72 – 0.97	598	$30 - $41
One-way switch-based utility load control – incremental	709	0.72 – 0.97	598	$17 - $23
Other Loads				
One-way switch-based Refrigeration – stand alone	75	1.75	131	$53
One-way switch-based Refrigeration – incremental	75	1.75	131	$39
One-way switch-based Elevators & HVAC Fans – stand alone	60	5.25	315	$38
One-way switch-based Elevators & HVAC Fans – incremental	60	5.25	315	$31

The supply curves below illustrate the cumulative electric peak load reduction available based on two scenarios. Scenario 1 (Exhibit 42) assumes that each measure cost would require new installation of gateways for communications between utility and devices, i.e., no existing communications gateways in place. Scenario 2 (Exhibit 43) assumes that there are existing gateways, so only incremental costs for additional control devices would be included.

Exhibit 42 Cumulative Supply Curve Including Gateway Costs

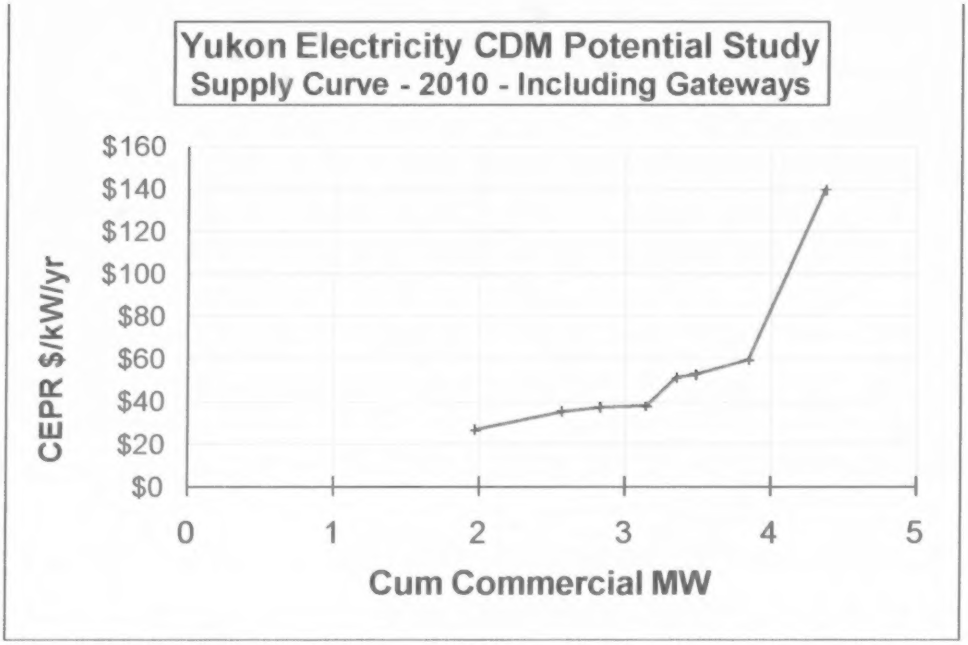
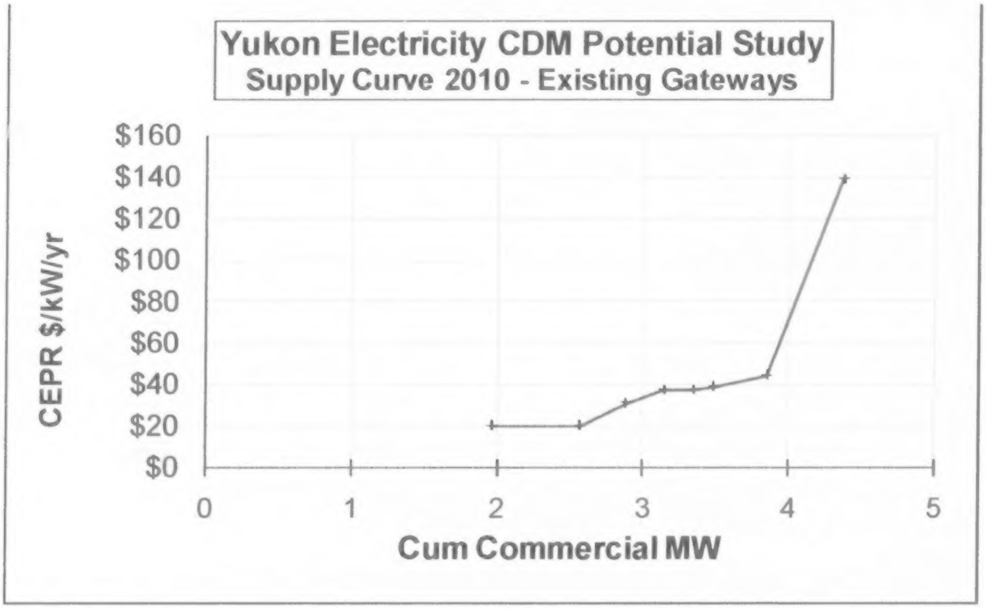


Exhibit 43 Cumulative Supply Curve with Existing Gateways (no cost)



As illustrated, including gateway costs, about 3.8 MW are technically available for under $60/kW/yr., after which another 0.60 MW (4.4 MW total) would be available for under $140/kW/yr. If existing gateways are in place, approximately 3.8 MW would be available for under $45/kW/yr. and 4.4 MW available for under $140/kW/yr. Electric thermal storage is significantly more expensive than the other measures, although it may still be viable in some specific cases.

It should be noted that there is a point beyond which electric peak load reductions, defined in terms of Peak Period 1 (6 pm on system peak day) become uneconomic if they create a new peak after those time periods as a result of deferral of the loads during the peak until other periods, such as immediately following the peak period.

In theory, this concept is applicable. However, in practice (i.e., applying Achievable Potential), it is highly unlikely that the saturation of electric peak load measures would be sufficient to cause such a shift. The application of electric thermal storage (ETS) would be the type of electric peak load measure that would have the greatest potential to create a new (later) peak if the full off-peak charging operation of the units were implemented immediately after the end of the peak period. As a result, it has been assumed that the off-peak charging period would begin at 11 pm, rather than earlier, such as 8 pm. For both space and water heating load control, it would be expected that some degree of "recovery" would follow load control periods in order to restore the temperature of the air/water to the pre-determined comfort levels. For lighting, plug loads and pool pumps/spas, the recovery would be minimal.

10 Achievable Potential: Electric Energy Forecast

10.1 Introduction

This section presents the Commercial sector Achievable Potential for the study period (2010 to 2030). The Achievable Potential is defined as the proportion of the energy-efficiency opportunities identified in the Economic Potential Forecast that could realistically be achieved within the study period.

The remainder of this discussion is organized into the following subsections:

- Description of Achievable Potential
- Approach to the estimation of Achievable Potential
- Results – energy-efficient technologies.

Additional information is provided in Appendix H.

10.2 Description of Achievable Potential

Achievable Potential recognizes that, in many instances, it is difficult to induce all customers to purchase and install all the energy-efficiency technologies that meet the criteria defined by the Economic Potential Forecast. For example, customer decisions to implement energy-efficient measures can be constrained by important factors such as:

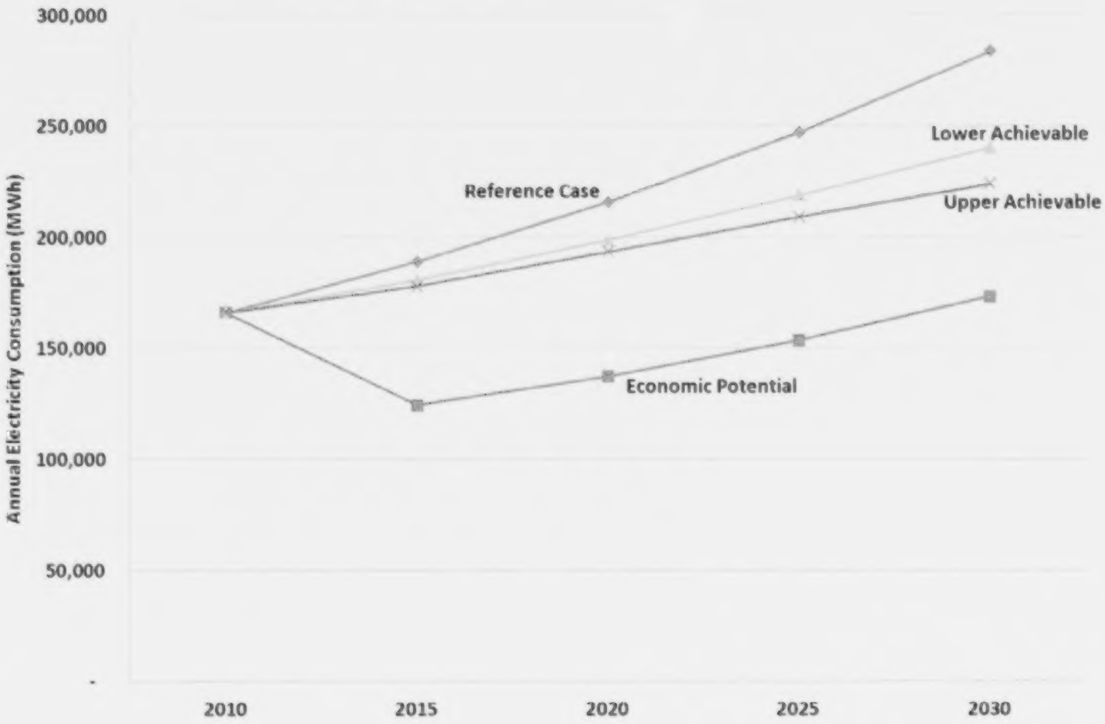
- Higher first cost of efficient product(s)
- Need to recover investment costs in a short period (payback)
- Lack of product performance information
- Lack of product availability.

The rate at which customers accept and purchase energy-efficiency products will be influenced by the level of financial incentives, information and other measures put in place by YECL, YEC, the Government of the Yukon, other levels of government, and the private sector to remove barriers such as those noted above.

Exhibit 44 presents the levels of electricity consumption that are estimated in the Achievable Potential scenario. As illustrated, the Achievable Potential scenarios are banded by the two forecasts presented in previous sections: the Economic Potential Forecast and the Reference Case.

As illustrated in Exhibit 44 energy savings under the Achievable Potential scenario are less than in the Economic Potential Forecast. In this CPR, the primary factor that contributes to the outcome shown in Exhibit 44 is the rate of market penetration. In the Economic Potential Forecast, efficient new technologies are assumed to fully penetrate the market as soon as it is economically attractive to do so. However, the Achievable Potential recognizes that under real world conditions, the rate at which customers are likely to implement new technologies will be influenced by additional practical considerations and will, therefore, occur more slowly than under the assumptions employed in the Economic Potential Forecast.

Exhibit 44 Annual Electricity Consumption—Energy-efficiency Achievable Potential Relative to Reference Case and Economic Potential Forecast for the Commercial Sector (MWh/yr.)



As also illustrated in Exhibit 44 the Achievable Potential results are presented as a band of possibilities, rather than a single line. This is because any estimate of Achievable Potential over a 20-year period is necessarily subject to uncertainty. Consequently, two Achievable Potential scenarios are presented: Lower and Upper.

The lower Achievable Potential assumes Yukon market conditions that are similar to those contained in the Reference Case. That is, the customers' awareness of energy-efficiency options and their motivation levels remain similar to those in the recent past, technology improvements continue at historical levels, and new energy performance standards continue as per current known schedules. It also assumes that the ability of the Yukon utilities and government to influence customers' decisions towards increased investments in energy-efficiency options remains roughly in line with previous company DSM experience.

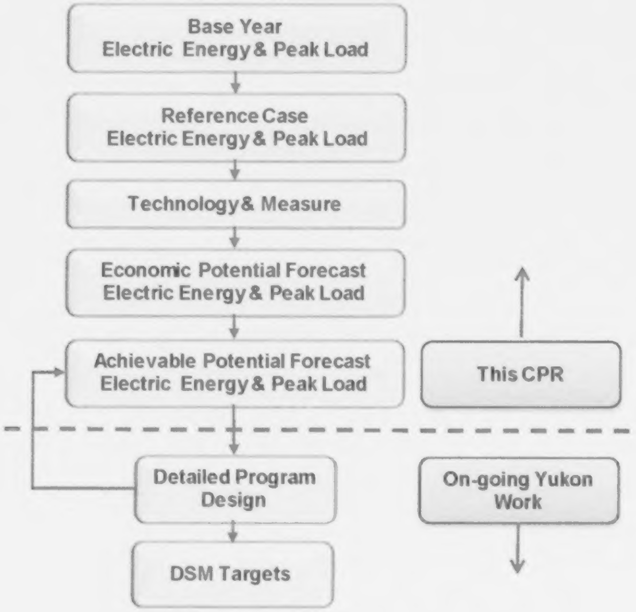
The upper Achievable Potential assumes Yukon market conditions that aggressively support investment in energy efficiency. For example, this scenario assumes that real energy prices increase over the study period. It also assumes that federal and territorial government actions to mitigate climate change result in increased levels of complementary energy-efficiency initiatives. The upper Achievable Potential typically does not reach Economic Potential levels; this recognizes that some portion of the market is typically constrained by barriers that cannot realistically be affected by DSM programs within the study period.

10.2.1 Achievable Potential Versus Detailed Program Design

It should also be emphasized that the estimation of Achievable Potential is not synonymous with either the setting of specific program targets or with program design. While both are closely linked to the discussion of Achievable Potential, they involve more detailed analysis that is beyond the scope of this study.

Exhibit 45 illustrates the relationship between Achievable Potential and the more detailed program design.

Exhibit 45 Achievable Potential versus Detailed Program Design


Base Year
Electric Energy & Peak Load
Reference Case
Electric Energy & Peak Load
Technology & Measure
Economic Potential Forecast
Electric Energy & Peak Load
Achievable Potential Forecast
Electric Energy & Peak Load
This CPR
Detailed Program Design
On-going Yukon Work
DSM Targets

10.3 Approach to the Estimation of Achievable Potential

Achievable Potential was estimated in a five-step approach.

- Priority opportunities were selected
- Opportunity profiles were created
- Opportunity worksheets were prepared
- A full-day workshop was held
- Workshop results were aggregated and applied to the remaining opportunities.

Further discussion is provided below.

Step 1 Select Priority Opportunities

The first step in developing the Achievable Potential estimates required selection of the energy saving opportunities identified in the Economic Potential Forecasts to be discussed during the Achievable workshop. Several criteria determined selection, including:

- The priority measures should represent a substantial fraction of the overall economic potential
- The priority measures should represent several different energy end uses
- The priority measures should have a variety of different likely patterns of market adoption, so the discussions will be widely varied.

A summary of the selected energy-efficiency actions, along with the approximate percentage that it represents in the Economic Potential Forecast, is provided in Exhibit 46.

Exhibit 46 Commercial Sector Actions – Energy Efficiency

Measure #	Measure	End use	2030 Savings (MWh/yr.)	Fraction of 2030 Economic Potential
C1	High-performance T8 Fixtures	General Lighting	4,212	4%
C2	White LEDs	Architectural Lighting	7,508	7%
C3	High-performance Glazing	Multiple	1,505	1%
C4	ENERGY STAR® Computers	Computer & Plug Load	4,608	4%
C5	High-efficiency Refrigeration	Refrigeration	4,399	4%
C6	LED Street Lighting	Street Lighting	2,802	3%
C7	Building Recommissioning	Multiple	8,446	8%
C8	High-performance New Construction	Multiple	53,045	48%
		Total	86,525	78%

Step 2 Create Opportunity Assessment Profiles

The next step involved the development of brief profiles for each of the opportunities noted above in Exhibit 46, in the form of PowerPoint slides. The slides are presented in Appendix H.

The purpose of the opportunity profiles was to provide a high-level logic framework that would serve as a guide for participant discussions in the Achievable workshop (see Step 4 below). The intent was to define a broad rationale and direction without getting into the much greater detail required of program design, which, as noted previously, is beyond the scope of this project. As illustrated in Appendix H, each opportunity profile addresses the following areas:

- Technology Description — provides a summary statement of the broad goal and rationale for the action.
- Target Sub Sector and Typical Application — highlights the sub sector and applications offering the most significant opportunities, and which provide a good starting point for discussion of the technology.
- Financial and Economic Indicators — provides estimates of average simple payback, cost of conserved electricity (CCE) and basis of assessment (full cost versus incremental).
- Eligible Participants — provides an estimate of the number of buildings or amount of floor space that could be affected during the study period if the entire Economic Potential were to be captured.
- Economic Potential versus Time — shows the pattern of the changing size of the opportunity over the study period, for existing and new buildings. Some opportunities grow steadily through the study period, as more and more appliances reach the age when they would be replaced. Other opportunities are economic to capture immediately, and after that the growth over time is limited to opportunities in new buildings being built. Still other opportunities decline with time as they are eroded by natural conservation activities.

Step 3 Prepare Opportunity Worksheets

A draft assessment worksheet was also prepared for each opportunity profile in advance of the Achievable workshop. The assessment worksheets complemented the information contained in the opportunity profiles by providing quantitative data on the potential energy savings for each opportunity as well as providing information on the size and composition of the eligible population of potential participants. Energy impacts and population data were taken from the detailed modelling results contained in the Economic Potential Forecast.

The worksheets, including the results recorded during the workshop discussions, are provided in Appendix I. As illustrated in Appendix I, each opportunity assessment worksheet addresses the following areas:

- Approximate Cost of Conserved Electricity — shows the approximate levelized cost of each kWh of electricity saved by the measure. For the purposes of the workshop, this information provided participants with an indication of the scope for using financial incentives to influence customer participation rates.
- Customer Payback — shows the simple payback from the customer's perspective for the package of energy-efficiency measures included in the opportunity. This information provided an indication of the level of attractiveness that the opportunity would present to customers. This provided an important reference point for the workshop participants when considering potential participation rates. When combined with the preceding CCE information, participants were able to roughly estimate the level of financial incentives that could be employed to increase the opportunity's attractiveness to customers without making it economically unattractive to the Yukon utilities.
- Economic Potential in Terms of Applicable Participants (e.g., number of buildings) — shows the total number of potential participants that could theoretically take part in the opportunity. Numbers shown are from the eligible populations used in the Economic Potential Forecasts.

- Participation Rates (%) — these fields were filled in during the workshops (described in Step 4 below), based on input from the participants. They show the percentage of economic savings that workshop participants concluded could be achievable in the last milestone period (usually 2030, but may be earlier for measures that peak earlier).
- Achievable Potential in Terms of Applicable Participants (e.g., number of buildings) — these fields were calculated by the spreadsheet based on the participation rates provided by the participants.
- Participation Rates Relative to the Discussion Scenario — these fields were filled in during the workshops to provide guidance to the consulting team on how participation might differ in other regions or dwelling types, or for related or similar technologies.
- Other Parameters — these fields were filled in during the workshop to capture highlights of the discussion.

Step 4 Conduct Achievable Workshop

The most critical step in developing the estimates of Achievable Potential was a one-day Achievable Potential workshop that was held on November 16, 2011. Workshop participants consisted of core members of the consultant team, DSM program and technical personnel from YECL, YEC, the Government of the Yukon, industry representatives, and representatives of other stakeholders. Together, the participating personnel brought many years of experience to the workshop related to the technologies and markets.

The purpose of this workshop was to:

- Promote discussion regarding the technical and market constraints confronting the identified energy-efficiency opportunities
- Identify potential strategies for addressing the identified constraints, including potential partners and delivery channels
- Compile participant views related to how much of the identified economic savings could realistically be achieved over the study period.

Following a brief consultant presentation that summarized the Commercial sector study results to date, the workshop provided a structured assessment of each of the selected opportunities. Opportunity assessment consisted of a facilitated discussion of the key elements affecting successful promotion and implementation of the DSM opportunity. More specifically:

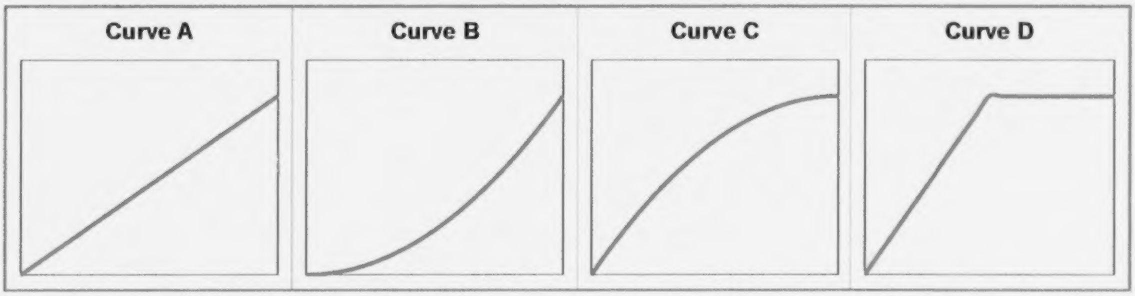
- What are the major constraints/challenges constraining customer adoption of the identified energy-efficiency opportunities?
- How big is the "won't" portion of the market for this opportunity?
- Preferred strategies and potential partners for addressing the identified constraints (high level only)
- Key criteria that determine customers' willingness to proceed
- Key potential channel partners

- Optimum intervention strategies e.g., push, pull, combination
- How sensitive is this opportunity to incentive levels?

Following discussion of market constraints and potential intervention strategies, the participants' views on potential participation rates were recorded. The process involved the following steps:

- The participation rate for the upper Achievable scenario in 2030 was estimated.
- The shape of the adoption curve was selected for the upper Achievable scenario. Rather than seek consensus on the specific values to be employed in each of the intervening years, workshop participants selected one of four curve shapes that best matched their view of the appropriate "ramp up" rate for each opportunity (see Exhibit 47 below).
- The process was then repeated for the lower Achievable scenario.
- Once participation rates had been established for the specific technology, sub sector and service region selected for the opportunity discussion, workshop participants provided the consultants with guidelines for extrapolating the discussion results to the other sub sectors and service regions included in the opportunity, but not discussed in detail during the workshop. Where time permitted, participants also discussed how the adoption of similar, related technologies might differ from the technology being discussed.

Exhibit 47 Participation Rate "Ramp Up" Curves



Curve A represents a steady increase in the expected participation rate over the study period.

Curve B represents a relatively slow participation rate during the first half of the study period followed by a rapid growth in participation during the second half of the 20-year study period.

Curve C represents a rapid initial participation rate followed by a relatively slow growth in participation during the remainder of the study period.

Curve D represents a very rapid initial participation rate that results in virtual full saturation of the applicable market during the first half of the study period.

In addition to the four curves described above, a fifth curve, the average of curves A and B was used by workshop participants to describe their estimation of the ramp up trajectory for several measures. This curve is referred to as "Curve A/B" below.

Step 5 Aggregate and Extend Opportunity Results

The final step involved aggregating the results of the individual opportunities to provide a view of the potential Achievable in both the Residential and Commercial sectors.

10.4 Achievable Workshop Results

The following sub sections present a summary of the workshop discussions for each of the commercial opportunities listed in Exhibit 46 above. Included for each opportunity are:

- Estimates of participation rates for 2030 and the corresponding participation "ramp up" curve made by workshop participants for both the upper and lower Achievable Potential scenarios
- Selected highlights that attempt to capture key discussion themes related to the opportunity, including a summary of potential barriers and strategies to overcome these barriers.

Appendix I provides copies of the assessment worksheets used during the workshop.

10.4.1 High-performance T8 Fixtures

Achievable workshop participants provided 2030 participation rate estimates of 95% for the upper Achievable Potential scenario and 50% for the lower Achievable Potential scenario. Participants thought the most likely adoption curve in both the upper and lower Achievable Potential scenario would be A/B.

Three main factors tending to lower adoption rates were identified by workshop participants:

Financial Barriers

- Split incentives in situations where landlords are responsible for capital investments while tenants are responsible for electricity bills
- Lack of access to capital for building owners.

Information Barriers

- Retailers may not be able to supply technical specifications or promote superior products based on specifications.

Institutional/cultural Barriers

- Stockpiling of less efficient linear fluorescent lamps (especially prevalent in government operations and a default option of "replacing like with like"
- Perception that standard T8 lamps and fixtures are a very efficient choice
- Contractors are accustomed to selling standard T8 lamps/fixtures.

Participants suggested that financial barriers could be addressed by including minimum energy performance requirements to government leases, or by offering extended lease terms to landlords who meet efficiency standards. Information barriers were thought to be best addressed by educating suppliers, allowing them to make sound recommendations to customers. Demonstrations of both lighting quality and energy savings were suggested as a strategy to overcome institutional/cultural barriers.

The initial discussion focused on existing hydro grid customers in Office buildings on the non-government rate. Participants believed participation would be somewhat higher for customers on the government rate. In Old Crow and the large and small diesel communities, participation would be lower, primarily based on ease of access to new lighting equipment. Participants also believed that a small number of sub sectors would have participation rates which differed from Office buildings, with Food Retail and Education having higher participation and restaurants having lower participation.

10.4.2 White LEDs

Achievable workshop participants provided 2030 participation rate estimates of 80% for the upper Achievable Potential scenario and 50% for the lower Achievable Potential scenario. Participants thought the most likely adoption curve in both the upper scenario would be A/B, while the most likely adoption trajectory for the lower scenario was Curve B. Participants noted that those remaining customers using incandescent lighting that do not adopt LED technology within the study period are likely to upgrade to CFLs.

Barriers to adoption rates identified by workshop participants fell into three main categories:

Institutional/Cultural Barriers

- Many large chains have requirements for a “common look and feel” among their buildings
- Chain stores must often have direction corporately for purchasing decisions
- Retrofits, especially of linear fluorescent fixtures, have sometimes been subject to inspection issues
- General mistrust of new product performance claims.

Financial Barriers

- High first cost may lead some consumers to wait for an expected reduction in lamp cost before upgrading to LEDs
- Lack of access to capital. Other non-energy investment opportunities may provide more attractive financial returns and, with limited investment capital, energy upgrade investments may be given lower priority.

Information Barriers

- The wide range of LED technology options presents a barrier as customers must understand the performance and suitability of the various options available to them
- Lack of knowledge and/or confidence in the claimed energy savings potential.

Participants suggested that institutional/cultural barriers could be addressed through improved procurement practices (especially in government), or through promoting more flexible procurement (especially for large chains). Suggestions to address informational barriers included pilot programs, publishing of cases studies or other demonstrations, including dissemination of information addressing non-energy benefits such as reduced maintenance costs. Financial barriers could be addressed through incentive or giveaway initiatives.

The initial discussion focused on existing hydro grid customers in Retail buildings on the non-government rate. Participants believed participation would be similar for customers on the government rate, and somewhat lower in non-retail applications and in the diesel communities.

10.4.3 High-performance Glazing

Achievable workshop participants provided 2030 participation rate estimates of 70% for the upper Achievable Potential scenario and 20% for the lower Achievable Potential scenario. Participants thought the most likely adoption curve in both the upper and lower Achievable Potential scenario would be A.

Three main factors tending to lower adoption rates were identified by workshop participants:

Financial Barriers

- High first cost and relatively long paybacks were cited as the most important barriers
- Energy savings are often not sufficient to justify very high-efficiency windows; must value other non-energy benefits such as comfort.

Technical Barriers

- Building lifespan is a major consideration, as windows have a very long lifetime. Buildings that are beyond half of their expected service life are unlikely candidates for this type of long term improvement.

Institutional/Cultural Barriers

- The default option is to “replace like with like,” especially when replacing only one or a few of the windows in a building
- Tenanted buildings are more challenging as the building owners typically pass the energy costs to the tenants.

Participants focused on suggesting solutions to address financial barriers. It was suggested that monetary incentives, with a payback threshold for significant uptake in the four to five year range, would encourage widespread adoption. Emphasis of non-energy benefits such as improved comfort was also seen as being very important.

The initial discussion focused on existing hydro grid customers in Office buildings on the non-government rate. Participants believed that participation rates would be similar in other building types and among government customers. For the purposes of this study, this measure is not applicable in the diesel communities, as electric space heating is disallowed under the diesel grid rates.

10.4.4 ENERGY STAR® Computers

Achievable workshop participants provided 2030 participation rate estimates of 50% for the upper Achievable Potential scenario and 25% for the lower Achievable Potential scenario. Participants thought the most likely adoption curve in the upper scenario would be A, while the most likely adoption trajectory for the lower scenario would be Curve B.

Three main factors tending to lower adoption rates were identified by workshop participants:

Market Barriers

- There are a limited number of suppliers physically located in Yukon. Much purchasing is likely done online through suppliers outside of the territory, which reduces the opportunity to influence customer decision-making

- Most buyers prioritize performance over energy efficiency.

Information Barriers

- Some purchasers believe that ENERGY STAR® labels only require default power management settings; in fact, the ENERGY STAR® standard now has requirements for overall power use and power supply efficiency.

Institutional/cultural Barriers

- Many larger businesses have centralized information technology (IT) purchasing. An estimated 5-10% of purchasing decisions are made outside of the territory.

Participants suggested that barriers could be best addressed through incentive, with both consumers and point-of-sale suggested as appropriate incentives targets. It was also suggested that energy and cost savings be promoted to IT, purchasing and accounting personnel. The Government of Yukon currently requires that all computer purchases meet ENERGY STAR® requirements, demonstrating that institutional barriers may be overcome through purchasing standards.

The initial discussion focused on existing hydro grid customers in Office buildings on the non-government rate. Participants believed that participation rates would be similar in other building types and within the diesel grids. Participants noted that government customers have already reached 100% participation by way of purchasing requirements.

10.4.5 High-efficiency Refrigeration Measures

Achievable workshop participants provided 2030 participation rate estimates of 100% in both the upper and lower Achievable Potential scenarios, reaching this level with a Curve D trajectory by 2015 and 2020 respectively.

Participants felt that this opportunity should be a relatively easy one to capture, given that many grocery stores have already done more expensive capital upgrades on their refrigeration systems. A single potential barrier, that some refrigerated case coverings would discourage “impulse buying,” was discussed. Participants suggested that a monetary incentive was not likely necessary, and that education should be sufficient to convince those stores who have not already to upgrade.

The initial discussion focused on existing hydro grid customers in Food Retail buildings. Participants believed participation would be lower in restaurants, the other primary user of refrigeration energy. In Old Crow and the large and small diesel communities, participation would be higher. This measure is applicable to very few customers on government rates.

10.4.6 LED Street Lighting

For both the upper and lower Achievable Potential scenario, workshop participants provided 2030 participation rate estimates of 100% with the most likely adoption curve being B. This measure is unique in that implementation is essentially an internal decision for the utilities (subject to regulatory approval).

Three main groups of barriers were identified by workshop participants:

Institutional/cultural Barriers

- Street lamp accounts currently pay a flat monthly fee. This rate structure does not provide incentive for upgrade, as it is difficult to recover capital costs through rate adjustments
- Utilities will require board approval to upgrade to LED street lighting, which will require that they understand the business case.

Technical Barriers

- LED streetlight installations require knowledge of lighting theory and an engineering approach
- Long useful life claims have not been proven in the field, or specifically in cold climates.

Financial Barriers

- High first cost.

Participation rates are not expected to vary by region.

Addressing the above mentioned barriers will fall to the utilities. Technical barriers related to cold climate performance are currently being assessed through two pilot programs being conducted by YEC and YECL. Institutional/cultural barriers related to rate structure remain an issue.

10.4.7 Building Recommissioning

- Achievable workshop participants provided 2030 participation rate estimates of 80% for the upper Achievable Potential scenario and 40% for the lower Achievable Potential scenario. Participants thought the most likely adoption curve in both the upper and lower Achievable Potential scenario would be B
- Two main factors tending to lower adoption rates were identified by workshop participants:

Market Barriers

- Local capacity to deliver recommissioning services in Yukon is very limited
- Operator training is required in many cases in order to promote savings persistence through improved operations practices
- Expertise in many areas (i.e., HVAC, controls, programming), which do not often exist within a single firm, may be required for some recommissioning projects.

Information Barriers

- Commercial building owners are often sceptical or unaware of the benefits of recommissioning.

Participants suggested that offering training to develop recommissioning skills locally would be the most effective way to overcome existing market barriers. Participants felt that information barriers would be best addressed by ensuring that customers have access to historical consumption data, and by providing notification and support in instances when consumption is irregularly high. It was felt that initiatives in government buildings could eventually be used to build an industry to support recommissioning activities in the private sector.

The initial discussion focused on existing hydro grid customers in Office buildings on the non-government rate. Participants believed participation would be somewhat lower for customers on the government rate. In Old Crow and the large and small diesel communities, participation would be similar. Recreation Centres were expected to have a higher participation rate, as there is currently significant recommissioning activity underway in this sub sector.

10.4.8 High-performance New Construction

Achievable workshop participants estimated of 95% of new construction will be built to a standard 60% more efficient than current practice under the upper Achievable Potential scenario and 45% under the lower Achievable Potential scenario. Under both scenarios, participants felt that all remaining buildings would be built to a standard at least 25% more efficient than current practice. Participants thought the most likely adoption curve in both the upper and lower Achievable Potential scenario would be B.

Two main factors tending to lower adoption rates were identified by workshop participants:

Market Barriers

Although the contracting community is likely capable, there is a lack of experience building ultra high-performance (equivalent to LEED Platinum) buildings in Yukon.

Financial Barriers

- High first cost
- Split incentives: Owner-occupied buildings represent less than 20% of the stock
- Builders may have difficulty recouping the additional capital cost in the sale price.

Participants suggested that educating commercial building owners to consider lifecycle costs and overall cash flows would encourage more energy-efficient construction. Expanding the practice of providing predicted energy costs as part of the leasing process was also suggested. Lastly, it was suggested that a government standard for energy performance in leased property would move the market toward more energy-efficient construction.

The discussion focused on all new construction. Variation between regions and sub sectors were not discussed.

10.4.9 Aggregate Results

Exhibit 48 summarizes the participant rates and "ramp up" curve assumptions discussed above.

Exhibit 48 Summary of Achievable Potential Participation Rates and Curves

Measure #	Measure	Lower Achievable Potential		Upper Achievable Potential	
		2030 Participation Factor	Adoption Curve	2030 Participation Factor	Adoption Curve
C1	High-performance T8 Fixtures	50%	A/B	95%	A/B
C2	White LEDs	50%	B	80%	A/B
C3	High-performance Glazing	20%	A	70%	A
C4	ENERGY STAR® Computers	25%	B	50%	A
C5	High-efficiency Refrigeration	100%	D (in 2015)	100%	D (in 2020)
C6	LED Street Lighting	100%	B	100%	B
C7	Building Recommissioning	40%	B	80%	B
C8	High-performance New Construction*	77%	B	98%	B

* New construction participation rates presented are effective rates, inclusive of those new buildings built to a standard either 40% or 25% more efficient than current practice. See Appendix H for details.

As noted earlier, it was not possible to fully address all opportunities in the one-day workshop. Consequently, the workshop focused on opportunities selected based on the criteria described in Step 1. Estimated participation rates for the remaining opportunities were extrapolated from the workshop results shown above and an aggregate set of results was prepared that included all of the eligible technologies.

The results shown in the attached appendices and in the following summary section incorporate the results of all these inputs.

10.5 Summary of Potential Electric Energy Savings

This section presents a summary of the electric energy savings for the upper and lower Achievable Potential scenarios. The summary is organized and presented in the following sub sections:

- Overview and selected highlights
- Electric energy savings – upper Achievable scenario
- Electric energy savings – lower Achievable scenario.

10.5.1 Overview and Selected Highlights

Exhibit 49 presents an overview of the results for the total Yukon service territory by milestone year, for three scenarios: Economic Potential, upper Achievable Potential and lower Achievable Potential.

Exhibit 49 Electricity by Milestone Year for Three Scenarios (MWh/yr.)

Year	Economic Potential Scenario		Upper Achievable Potential Scenario		Lower Achievable Potential Scenario	
	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case	Potential Savings (MWh/yr.)	% Savings Relative to Ref Case
2015	64,612	34%	11,122	6%	8,269	4%
2020	78,419	36%	22,377	10%	17,208	8%
2025	93,542	38%	38,017	15%	28,206	11%
2030	110,406	39%	59,819	21%	43,617	15%

Selected Highlights – Potential Electric Energy Savings

Selected highlights of the potential electric energy savings for the upper and lower Achievable Potential scenarios shown in Exhibit 49 are summarized below. Further detail is provided in the following sub sections and in the accompanying appendices.

Savings by Milestone Year

Compared to the Economic Potential Scenario, savings in both Achievable scenarios are achieved more steadily throughout the period. In the upper Achievable Potential scenario, 19% of the ultimate 2030 savings would be achieved by 2015, rising to 37% in 2020 and 64% by 2020. In the lower Achievable Potential scenario, 19% of the 2030 savings would be achieved by 2015, rising to 39% in 2020 and 65% by 2025. Although there are some measures in both scenarios that can be implemented early in the study period, the majority are expected to follow an adoption curve that starts slowly and builds up towards 2030.

Savings by Sub Sector

Offices account for approximately 17% of the upper Achievable Potential savings and 16 % of lower Achievable Potential Savings in 2030. Other high savings sub sectors include Education (12% & 11% in the upper and lower scenarios respectively), Non-food Retail (11% & 10%) and Food Retail (9% & 11%). Other General Service Buildings account for 14% of savings in both scenarios. This distribution is primarily a reflection of the large share of commercial electricity consumed in these sub sectors, although sub sectors in which space heating makes up a relatively large portion of total electricity use tend to have relatively higher than average Achievable savings.

Savings by Supply Type and Government versus Non-government Accounts

The accounts connected to the hydro grid are expected to account for approximately 96% of potential savings in 2030. In absolute terms, non-government accounts provide about two times the savings as government accounts. In relative terms, non-government accounts have larger percentage savings relative to the Reference Case when compared to government accounts. This is largely driven by input from the Achievable workshop participants, as discussed above.

The diesel grid systems make up a smaller portion of the potential savings relative to their contribution to total Reference Case consumption. Many of the most promising measures reduce electric space heating consumption (especially in new construction) and there is little or no electric space heating in those communities.

Savings by End Use

In 2030, HVAC savings account for 41% and 39% of upper and lower Achievable Potential savings, respectively. Indoor lighting accounts for 36% and 37% of 2030 savings under the upper and lower scenarios.

Over time, indoor lighting decreases as a share of overall savings through time, while HVAC increases. For example, in the lower Achievable scenario, indoor lighting accounts for 48% of savings in 2015 (37% in 2030), while HVAC accounts for only 23% (39% in 2030). This is driven by two factors:

- Early milestone years present more lighting opportunities. These opportunities tend to be relatively low-cost, familiar technologies that workshop participants felt will be adopted relatively quickly. A significant portion of these opportunities are not available in later milestone years as a result of incoming legislation which is expected to transform the market for some lighting technologies

- Overall electric space heating shares increase rapidly through time, as more new electrically heated buildings are added to the stock. This presents a growing opportunity for conservation.

10.5.2 Electric Energy Savings – Upper Achievable Scenario

The following exhibits present the potential electricity savings under the upper Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 50 presents the results by supply system, by government versus non-government accounts and by milestone year

- Exhibit 51 presents the results by sub sector, service region and milestone year

- Exhibit 52 presents the results by end use, service region and milestone year.

- Exhibit 53 presents the results graphically for the entire Yukon service territory by major end use and milestone year

- Exhibit 54 presents the results graphically for the entire Yukon service territory by sub sector and vintage

- Exhibit 55 presents the distribution of savings for each end use by region.

Exhibit 50 Upper Achievable Electricity Savings for Yukon by Supply System and Government vs Non-government Customers (MWh/yr.)

Supply System	Rate	2015	2020	2025	2030	2030 Savings relative to Ref Case (%)	Fraction of Total 2030 Savings (%)
Hydro Grid	Non-government	6,855	14,336	24,812	39,289	22%	65.7%
	Government	3,626	6,870	11,459	18,183	20%	30.4%
Large Diesel	Non-government	326	614	932	1,254	23%	2.1%
	Government	135	230	329	440	22%	0.7%
Small Diesel	Non-government	82	158	236	310	22%	0.5%
	Government	52	79	107	137	19%	0.2%
Old Crow	Non-government	20	44	73	109	20%	0.2%
	Government	27	46	68	97	20%	0.2%
Grand Total		11,122	22,377	38,017	59,819	21%	100%

Exhibit 51 Upper Achievable Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.)

Region	Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Street Lighting	Block Heater	Total
Hydro Grid	2015	1,219	2,922	362	581	800	20	229	332	1,770	13	7	2,072	145	10	10,481
	2020	2,892	5,251	1,080	1,261	2,957	78	848	823	2,361	36	32	2,971	592	25	21,207
	2025	5,000	7,067	2,253	2,099	7,102	204	2,016	1,612	3,105	74	56	4,251	1,387	47	36,271
	2030	8,044	8,542	3,999	3,179	14,012	433	3,926	2,876	4,035	132	84	5,508	2,620	82	57,472
Large Diesel	2015	52	150	17	28	1	1	8	21	65	1	0	109	9	0	461
	2020	119	267	48	58	4	3	31	45	81	1	1	153	33	0	844
	2025	189	349	92	90	8	7	71	75	98	3	2	207	72	0	1,262
	2030	271	399	150	126	13	12	128	111	116	4	2	240	120	1	1,694
Small Diesel	2015	13	49	2	8	0	0	2	7	30	0	0	19	3	0	134
	2020	29	86	7	16	1	0	9	15	35	0	1	26	13	0	237
	2025	45	112	13	24	2	1	19	23	39	1	1	34	29	0	343
	2030	62	127	21	33	4	2	32	33	44	1	1	38	48	1	447
Old Crow	2015	8	16	1	3	0	0	1	2	14	0	0	0	1	-	46
	2020	19	28	4	6	1	0	4	5	17	0	0	1	4	-	89
	2025	32	37	8	10	1	0	11	9	22	0	0	2	8	-	141
	2030	51	44	14	14	2	0	22	14	27	1	0	2	14	-	206
Total	2015	1292	3137	382	619	801	21	240	362	1879	14	8	2199	158	10	11,122
	2020	3059	5632	1139	1340	2963	81	893	888	2493	38	34	3150	642	25	22,377
	2025	5266	7565	2366	2223	7114	212	2117	1719	3263	78	58	4493	1495	48	38,017
	2030	8428	9112	4185	3352	14031	447	4108	3034	4222	139	88	5789	2802	83	59,819

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) In the above exhibit a value displays as 0 if it is between 0 and 0.5. Totals are calculated using the actual numerical value.
4) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the upper Achievable Potential scenario are implemented.

Exhibit 52 Upper Achievable Potential Electricity Savings by End Use and Milestone Year (MWh/yr.)

Sub Sector	2015	2020	2025	2030
Office	1,819	3,695	6,323	10,076
Food Retail	1,850	2,748	4,042	5,416
Non-food Retail	1,077	2,393	4,076	6,407
Hotel / Motel	560	1,322	2,397	3,969
Healthcare	308	655	1,175	1,962
Education	1,179	2,424	4,249	7,004
Recreation Centres	382	883	1,564	2,512
Restaurant	867	1,598	2,534	3,726
Warehouse / Wholesale	650	1,581	3,016	5,201
Other General Service Buildings	1,634	3,291	5,461	8,498
Street lighting	158	642	1,495	2,802
Parking Lot Plug	10	25	48	83
General Service Buildings - Diesel Regions	628	1,120	1,636	2,164
Total	11,122	22,377	38,017	59,819

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the upper Achievable Potential scenario are implemented.

Exhibit 53 Upper Achievable Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.)

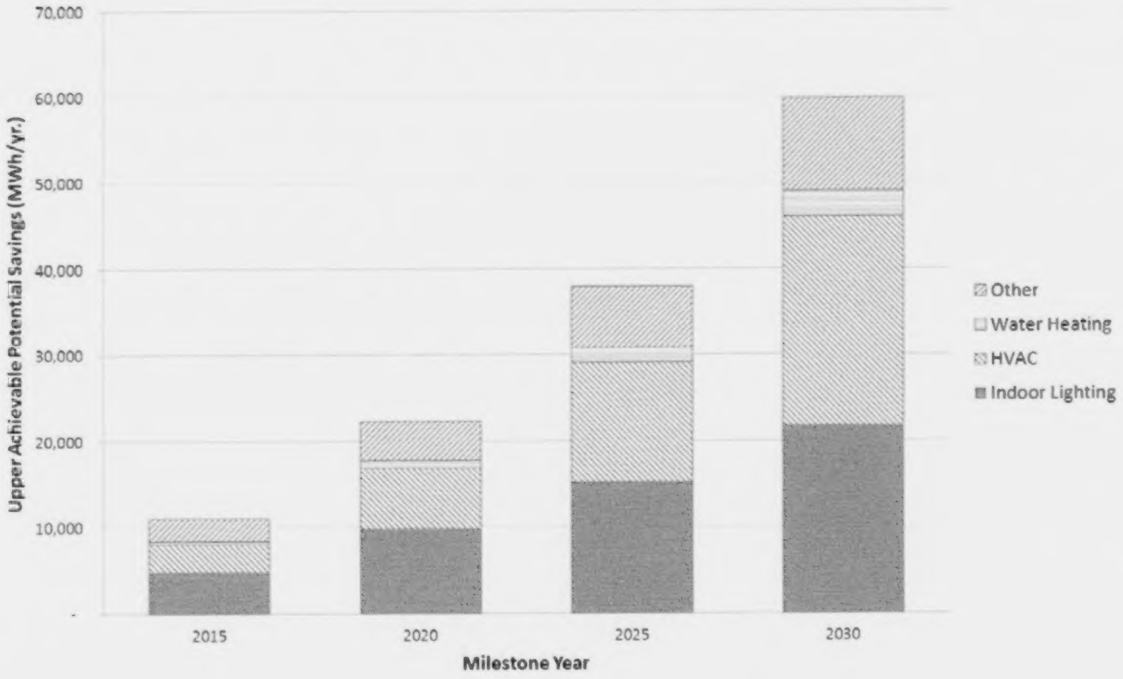


Exhibit 54 Upper Achievable Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.)

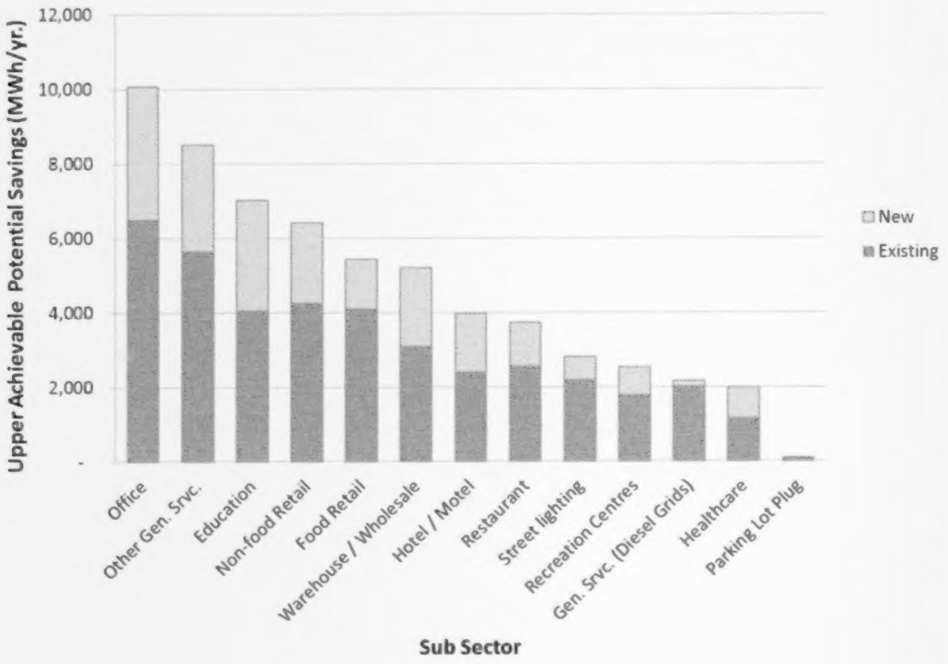
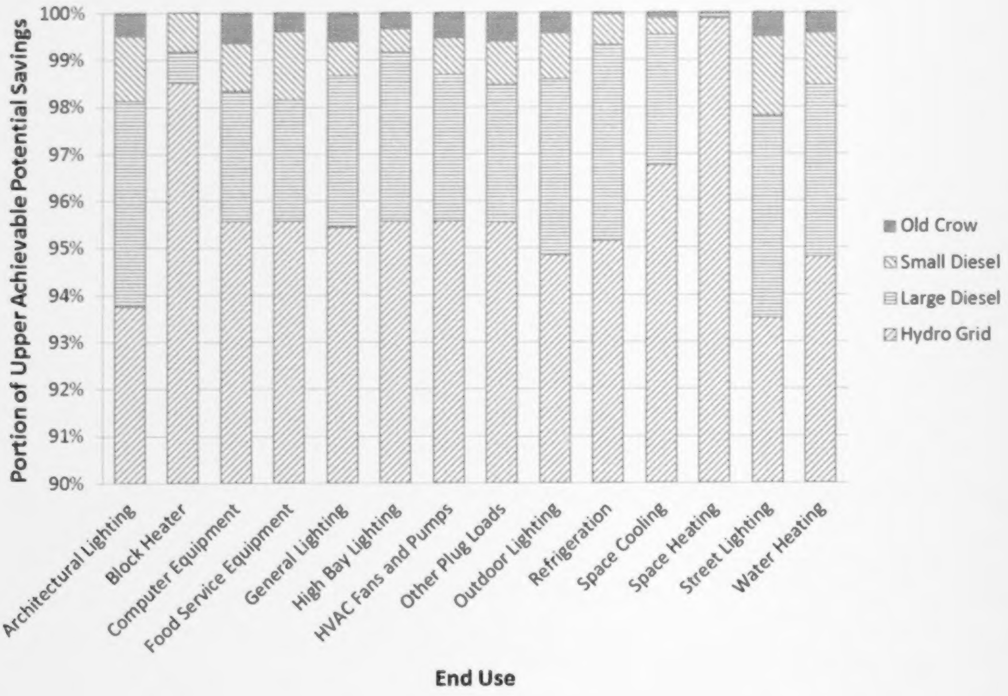


Exhibit 55 Upper Achievable Potential Savings Distribution by Major End Use and Region - 2030 (%)



10.5.3 Electric Energy Savings – Lower Achievable Scenario

The following exhibits present the potential electricity savings under the lower Achievable Potential scenario. The results shown are relative to the Reference Case. The results are broken down as follows:

- Exhibit 56 presents the results by supply system, by government versus non-government accounts, and by milestone year
- Exhibit 57 presents the results for the hydro grid by sub sector, end use and milestone year
- Exhibit 58 presents the results for the diesel grids by end use and milestone year
- Exhibit 59 presents the results graphically for the entire Yukon service territory by major end use and milestone year
- Exhibit 60 presents the results graphically for the entire Yukon territory by sub sector and vintage
- Exhibit 61 presents the distribution of savings for each end use by region.

Exhibit 56 Lower Achievable Electricity Savings for Yukon by Supply System and Government vs Non-government Customers (MWh/yr.)

Supply System	Rate	2015	2020	2025	2030	2030 Savings relative to Ref Case (%)	Fraction of Total 2030 Savings (%)
Hydro Grid	Non-government	4,748	11,018	18,469	28,783	16%	66.0%
	Government	3,019	5,240	8,374	13,065	14%	30.0%
Large Diesel	Non-government	240	506	741	961	18%	2.2%
	Government	115	180	244	312	16%	0.7%
Small Diesel	Non-government	63	131	191	245	17%	0.6%
	Government	46	65	83	100	14%	0.2%
Old Crow	Non-government	14	32	52	79	14%	0.2%
	Government	23	37	52	72	15%	0.2%
Grand Total		8,269	17,208	28,206	43,617	15%	100%

Exhibit 57 Lower Achievable Potential Electricity Savings by End Use, Service Region and Milestone Year (MWh/yr.)

Region	Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Street Lighting	Block Heater	Total
Hydro Grid	2015	651	2,841	193	417	372	11	121	170	1,551	7	2	1,282	145	5	7,768
	2020	1,604	5,025	600	874	1,579	48	480	454	1,923	19	9	3,038	592	13	16,258
	2025	2,924	6,626	1,308	1,426	4,188	135	1,207	962	2,464	39	16	4,137	1,387	25	26,843
	2030	4,957	7,772	2,430	2,143	8,905	298	2,467	1,835	3,236	70	24	5,048	2,620	43	41,849
Large Diesel	2015	27	146	9	20	0	0	4	10	56	0	0	72	9	0	355
	2020	64	256	25	40	2	2	16	23	64	1	0	160	33	0	686
	2025	103	329	50	60	4	4	38	39	75	1	0	209	72	0	985
	2030	151	368	83	82	6	7	70	60	91	2	1	232	120	0	1,273
Small Diesel	2015	7	47	1	6	0	0	1	3	28	0	0	12	3	0	109
	2020	15	83	4	11	1	0	4	7	30	0	0	27	13	0	196
	2025	24	106	7	16	1	1	10	12	34	0	0	35	29	0	274
	2030	34	117	11	22	2	1	17	17	38	1	0	38	48	0	345
Old Crow	2015	4	15	1	2	0	0	1	1	12	0	0	0	1	-	37
	2020	10	27	2	4	0	0	3	3	15	0	0	1	4	-	68
	2025	19	35	5	7	1	0	7	5	18	0	0	1	8	-	104
	2030	30	40	9	10	1	0	13	8	22	0	0	1	14	-	150
Total	2015	689	3050	204	445	373	11	127	184	1647	7	2	1367	158	5	8,269
	2020	1693	5391	631	929	1582	50	503	486	2032	20	10	3226	642	13	17,208
	2025	3069	7096	1369	1509	4193	139	1261	1018	2591	41	17	4382	1495	25	28,206
	2030	5172	8297	2532	2256	8914	307	2567	1920	3387	73	25	5320	2802	44	43,617

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) In the above exhibit a value displays as 0 if it is between 0 and 0.5. Totals are calculated using the actual numerical value.
4) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the lower Achievable Potential scenario are implemented.

Exhibit 58 Lower Achievable Potential Electricity Savings by End Use and Milestone Year (MWh/yr.)

Sub Sector	2015	2020	2025	2030
Office	1,390	2,583	4,299	6,868
Food Retail	1,224	2,842	3,943	4,938
Non-food Retail	831	1,751	2,900	4,510
Hotel / Motel	428	950	1,680	2,773
Healthcare	249	486	839	1,386
Education	935	1,767	3,005	4,931
Recreation Centres	209	488	892	1,495
Restaurant	654	1,396	2,096	2,938
Warehouse / Wholesale	433	1,017	1,954	3,449
Other General Service Buildings	1,265	2,373	3,824	5,897
Street lighting	158	642	1,495	2,802
Parking Lot Plug	5	13	25	44
General Service Buildings - Diesel Regions	488	899	1,254	1,586
Total	8,269	17,208	28,206	43,617

Notes:
1) Results are measured at the customer's point-of-use and do not include line losses.
2) Any differences in totals are due to rounding.
3) In the above exhibit a value displays as 0 if it is between 0 and 0.5. Totals are calculated using the actual numerical value.
4) MWh/yr. savings are not incremental. The space heating savings in 2030 are not in addition to the savings from the previous milestone years. Rather, they are the difference between the Reference Case space heating consumption in 2030 and the space heating consumption if all the measures included in the lower Achievable Potential scenario are implemented.

Exhibit 59 Lower Achievable Potential Electricity Savings by Major End Use and Milestone Year (MWh/yr.)

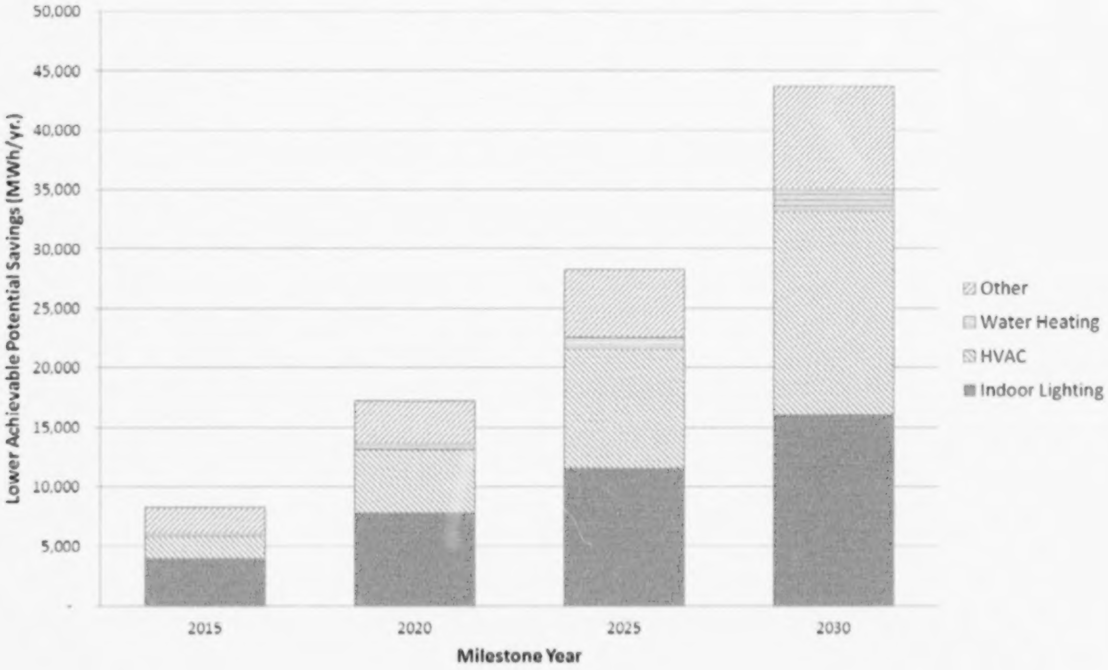


Exhibit 60 Lower Achievable Potential Savings by Sub Sector and Vintage – 2030 (MWh/yr.)

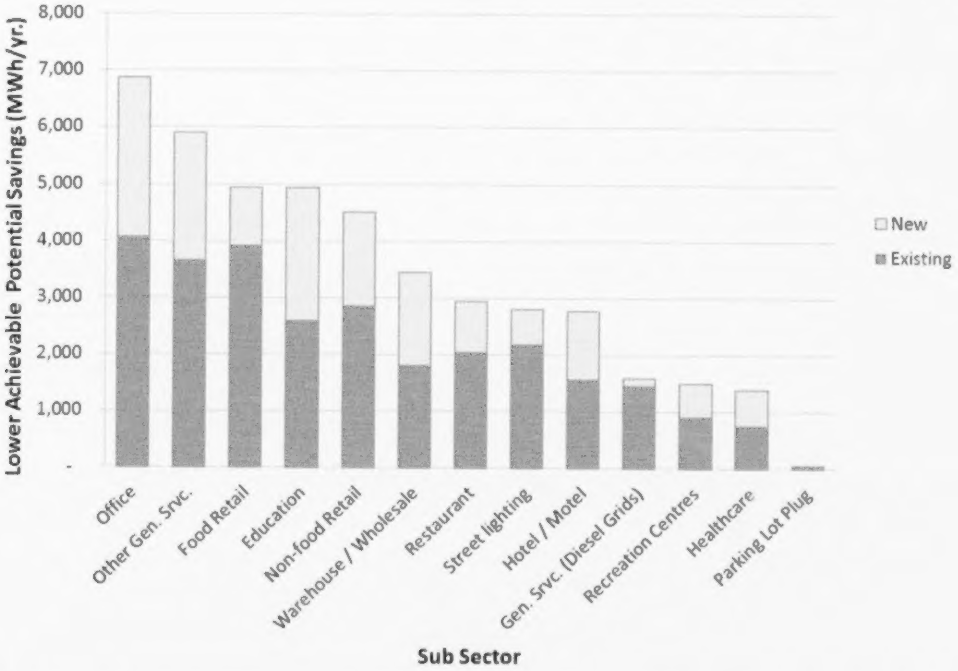
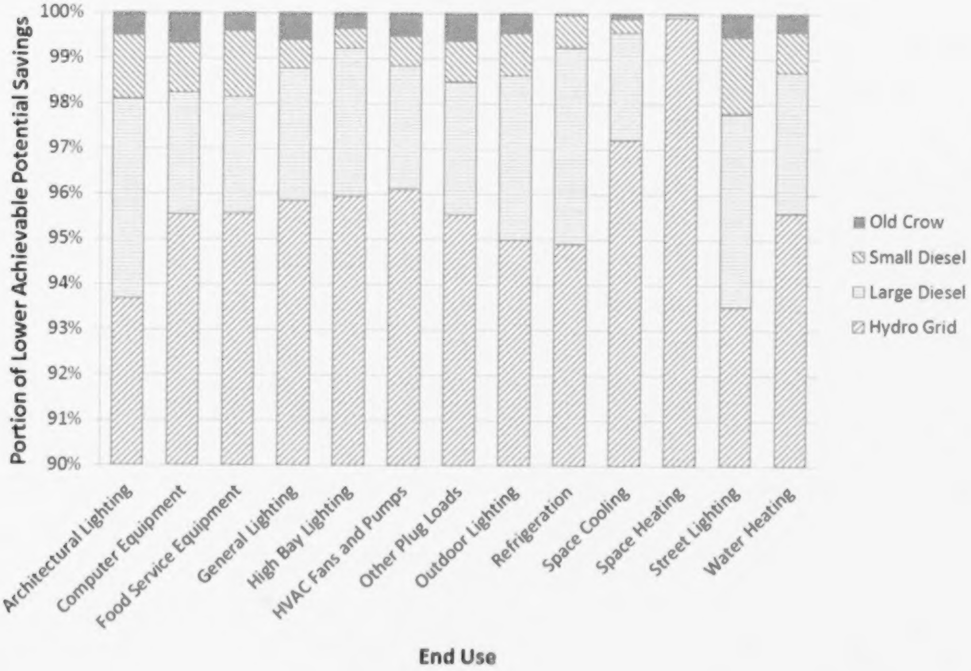


Exhibit 61 Lower Achievable Potential Savings Distribution by Major End Use and Region - 2030 (%)



10.6 Summary of Electric Peak Load Reductions

This section presents a summary of the electric peak load reductions that would result from the electric energy savings presented above for the upper and lower Achievable scenarios. The summary is organized and presented in the following sub sections:

- Overview and selected highlights
- Electric peak load reductions – upper Achievable scenario
- Electric peak load reductions – lower Achievable scenario

10.6.1 Overview and Selected Highlights

Exhibit 62 presents an overview of the results for the total Yukon service territory by milestone year for each of the Achievable Potential scenarios. As illustrated, by 2030 peak hour load reductions resulting from implementation of the energy-efficiency measures are estimated to range from 8.5 MW to 11.9 MW for the lower and upper Achievable Potential scenarios, respectively. Additional highlights are provided below.

Exhibit 62 Electric Peak Load Reductions, Upper and Lower Achievable Potential Scenarios (MW)

Scenario & Milestone	Period 1 Annual Peak Hour	Period 2 Weekday System Peak	Period 3 Weekday Morning Peak
Upper Achievable			
2015	1.9	1.8	1.8
2020	4.1	3.7	4.1
2025	7.3	6.6	7.5
2030	11.9	10.7	12.5
Lower Achievable			
2015	1.4	1.3	1.3
2020	3.1	2.7	3.0
2025	5.3	4.7	5.3
2030	8.5	7.6	8.9

Selected Highlights – Potential Electric Peak Load Reductions

The results presented above are notable in that energy-efficiency activities contribute more heavily to reductions in the weekday morning peak period (Peak Period 3) than to either of the other two peak periods. This is primarily driven by measures that affect space heating, which is more highly coincident with Peak Period 3 in commercial buildings than with either of the other two peak periods. Other end uses with high coincident peak loads, such as outdoor lighting and block heaters, also tend to contribute disproportionally to peak reductions.

Further discussion of the electric peak load reductions under the upper Achievable Potential forecast and the lower Achievable Potential forecast are presented in the following sub sections.

10.6.2 Electric Peak Load Reductions Under the Upper Achievable Potential Scenario

Exhibit 63 presents a summary of the peak load reductions for the hydro grid that would occur as a result of the electric energy savings contained in the upper Achievable Potential forecast.

The reductions are shown by milestone year, sub sector and peak period. In each case, the reductions are an average value over the peak period and are defined relative to the Reference Case presented previously in Section 6. Exhibit 64 shows upper Achievable savings in the three peak periods for the three diesel regions. As discussed in Section 9, Exhibit 63 and Exhibit 64 approximate the potential demand impacts associated with the energy-efficiency measures, because they are based on the assumption that the measures do not change the load shape of the end uses they affect.

Exhibit 63 Electric Peak Load Reductions from Upper Achievable Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector (MW)

Sub Sector	Year	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
Office	2015	0.3	0.3	0.3
	2020	0.7	0.6	0.7
	2025	1.2	1.1	1.4
	2030	2.0	1.8	2.3
Food Retail	2015	0.2	0.2	0.2
	2020	0.4	0.4	0.3
	2025	0.5	0.5	0.5
	2030	0.8	0.8	0.8
Non-food Retail	2015	0.2	0.2	0.2
	2020	0.5	0.5	0.4
	2025	0.9	0.8	0.7
	2030	1.4	1.4	1.2
Hotel / Motel	2015	0.1	0.1	0.1
	2020	0.3	0.2	0.2
	2025	0.5	0.4	0.5
	2030	0.8	0.7	0.8
Healthcare	2015	0.1	0.0	0.0
	2020	0.1	0.1	0.1
	2025	0.2	0.2	0.2
	2030	0.4	0.3	0.4
Education	2015	0.2	0.2	0.2
	2020	0.4	0.4	0.5
	2025	0.7	0.7	1.0
	2030	1.3	1.1	1.8
Recreation Centres	2015	0.1	0.1	0.1
	2020	0.2	0.2	0.2
	2025	0.3	0.3	0.3
	2030	0.5	0.5	0.5
Restaurant	2015	0.1	0.1	0.1
	2020	0.3	0.3	0.3
	2025	0.5	0.4	0.4

Sub Sector	Year	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
	2030	0.7	0.6	0.7
Warehouse / Wholesale	2015	0.1	0.1	0.1
	2020	0.3	0.3	0.3
	2025	0.6	0.6	0.7
	2030	1.1	1.0	1.2
Other General Service Buildings	2015	0.3	0.3	0.3
	2020	0.6	0.5	0.6
	2025	1.1	0.9	1.1
	2030	1.7	1.5	1.8
Parking Lot Plug	2015	0.0	0.0	0.0
	2020	0.0	0.0	0.0
	2025	0.0	0.0	0.0
	2030	0.1	0.1	0.0
Non-Buildings	2015	-	-	-
	2020	-	-	-
	2025	-	-	-
	2030	-	-	-
Street lighting	2015	0.0	0.0	0.0
	2020	0.2	0.1	0.2
	2025	0.4	0.3	0.4
	2030	0.7	0.5	0.7
Total	2015	1.8	1.7	1.7
	2020	3.9	3.5	3.9
	2025	7.0	6.3	7.2
	2030	11.4	10.3	12.2

Exhibit 64 Electric Peak Load Reductions from Upper Achievable Energy Savings Measures, by Milestone Year and Sub Sector – Diesel Grids (kW)

Sub Sector / Milestone Year	Large Diesel			Small Diesel			Old Crow		
	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
General Service Buildings									
2015	79	70	66	23	20	19	9	7	7
2020	148	129	118	41	36	33	17	14	13
2025	222	193	172	59	51	47	26	23	20
2030	301	260	227	77	66	59	39	33	28
Non-Buildings									
2015	0	0	0	0	0	0	-	-	-
2020	0	0	0	0	0	0	-	-	-
2025	0	0	0	0	0	0	-	-	-
2030	0	0	0	0	0	0	-	-	-
Street lighting	0	0	0	0	0	0	-	-	-
2015	2	2	2	1	1	1	0	0	0
2020	9	7	9	3	3	4	1	1	1
2025	18	15	20	7	6	8	2	2	2
2030	31	25	33	12	10	13	4	3	4
Total									
2015	82	72	68	24	21	20	9	8	7
2020	157	136	127	45	39	37	18	15	14
2025	241	208	192	66	57	54	29	24	22
2030	332	285	260	89	76	72	43	36	32

10.6.3 Electric Peak Load Reductions Under the Lower Achievable Potential Scenario

Exhibit 65 presents a summary of the peak load reductions for the hydro grid that would occur as a result of the electric energy savings contained in the lower Achievable Potential forecast. The reductions are shown by milestone year, sub sector and peak period. In each case, the reductions are an average value over the peak period and are defined relative to the Reference Case presented previously in Section 6. Exhibit 66 shows lower Achievable savings in the three peak periods for the three diesel regions. As discussed in Section 9, Exhibit 65 and Exhibit 66 approximate the potential demand impacts associated with the energy-efficiency measures, because they are based on the assumption that the measures do not change the load shape of the end uses they affect.

Exhibit 65 Electric Peak Load Reductions from Lower Achievable Energy Savings Measures, by Milestone Year, Peak Period and Sub Sector (MW)

Sub Sector	Year	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
Office	2015	0.3	0.2	0.2
	2020	0.5	0.4	0.5
	2025	0.8	0.7	0.9
	2030	1.3	1.2	1.5
Food Retail	2015	0.2	0.2	0.1
	2020	0.4	0.4	0.3
	2025	0.5	0.5	0.5
	2030	0.7	0.7	0.6
Non-food Retail	2015	0.1	0.1	0.1
	2020	0.3	0.3	0.3
	2025	0.6	0.6	0.5
	2030	1.0	0.9	0.9
Hotel / Motel	2015	0.1	0.1	0.1
	2020	0.2	0.2	0.2
	2025	0.3	0.3	0.3
	2030	0.6	0.5	0.6
Healthcare	2015	0.0	0.0	0.0
	2020	0.1	0.1	0.1
	2025	0.2	0.1	0.2
	2030	0.3	0.2	0.3
Education	2015	0.2	0.1	0.2
	2020	0.3	0.3	0.4
	2025	0.5	0.5	0.7
	2030	0.9	0.8	1.2
Recreation Centres	2015	0.0	0.0	0.0
	2020	0.1	0.1	0.1
	2025	0.2	0.2	0.2
	2030	0.3	0.3	0.3
Restaurant	2015	0.1	0.1	0.1
	2020	0.2	0.2	0.2
	2025	0.4	0.3	0.3
	2030	0.5	0.5	0.5
Warehouse / Wholesale	2015	0.1	0.1	0.1
	2020	0.2	0.2	0.2
	2025	0.4	0.4	0.4
	2030	0.7	0.7	0.8
Other General Service Buildings	2015	0.2	0.2	0.2
	2020	0.4	0.4	0.4
	2025	0.7	0.6	0.8
	2030	1.2	1.0	1.3
Parking Lot Plug	2015	0.0	0.0	0.0
	2020	0.0	0.0	0.0
	2025	0.0	0.0	0.0

Sub Sector	Year	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
	2030	0.0	0.0	0.0
Non-Buildings	2015	-	-	-
	2020	-	-	-
	2025	-	-	-
	2030	-	-	-
Street lighting	2015	0.0	0.0	0.0
	2020	0.2	0.1	0.2
	2025	0.4	0.3	0.4
	2030	0.7	0.5	0.7
Total	2015	1.3	1.2	1.3
	2020	2.9	2.6	2.8
	2025	5.0	4.5	5.1
	2030	8.1	7.3	8.6

Exhibit 66 Electric Peak Load Reductions from Lower Achievable Energy Savings Measures, by Milestone Year and Sub Sector – Diesel Grids (kW)

Sub Sector / Milestone Year	Large Diesel			Small Diesel			Old Crow		
	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period	Period 1 Peak Hour	Period 2 System Peak Period	Period 3 Morning Peak Period
General Service Buildings									
2015	60	53	51	18	16	16	7	6	6
2020	113	100	95	32	28	27	12	10	10
2025	162	142	132	44	38	37	19	16	14
2030	210	183	166	54	47	44	27	23	20
Non-Buildings									
2015	0	0	0	0	0	0	-	-	-
2020	0	0	0	0	0	0	-	-	-
2025	0	0	0	0	0	0	-	-	-
2030	0	0	0	0	0	0	-	-	-
Street lighting									
2015	2	2	2	1	1	1	0	0	0
2020	9	7	9	3	3	4	1	1	1
2025	18	15	20	7	6	8	2	2	2
2030	31	25	33	12	10	13	4	3	4
Total									
2015	62	55	53	19	17	17	7	6	6
2020	122	107	104	36	31	31	13	11	11
2025	181	157	152	51	44	44	21	18	17
2030	241	209	199	67	57	57	31	26	24

11 References

American Council for an Energy-Efficient Economy (H. Sachs, S. Nadel, J. Thorne Amann, M. Tuazon, and E. Mendelsohn), Davis Energy Group (L. Rainer) and Marbek Resource Consultants (G. Todesco, D. Shipley, and M. Adelaar). *Emerging Energy-Saving Technologies and Practices in the Buildings Sector as of 2004.* October 2004.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). *ASHRAE Handbook—HVAC Applications*. 2011.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). *ANSI/ASHRAE/IESNA Standard 90.1-2010. Energy Standard for Buildings Except Low-Rise Residential Buildings*. 2010.

BC Hydro. Powersmart. *QA Standard. Technology: Effective Measure Life*. September 2006.

City of Whitehorse Bylaw 99-50. *Building and Plumbing Bylaw*. Consolidated October 13, 2010

Ecos Consulting. *Market Research Report: LED Lighting Technologies and Potential for Near-Term Applications*. Report E03-114. Prepared for Northwest Energy Efficiency Alliance. June 2, 2003.

Energy and Environmental Analysis Inc. *Market Research Report: Light Commercial HVAC Report*. Report EO5-143. Prepared for Northwest Energy Efficiency Alliance. July 25, 2005.

Fisher, Don. Food Service Technology Center (FSTC). *Commercial Cooking Appliance Technology Assessment*, 2002.

ICF International. *Solid State Lighting: Vision 2020*. Prepared for Natural Resources Canada. (Forthcoming).

ICF Marbek. *Energy Efficiency Measure Cost and Performance Database*. (Internal Files).

ICF Marbek in Association with Lopes Consulting Services and Dr. Rob Dumont. *SaskPower Electricity Conservation Potential Review 2010*. May 2011.

Kats, Greg, Capital E. California Department of Health Services and Lawrence Berkley National Laboratory. *The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force*, October 2003.

Kema-Xenergy Inc. *Market Research Report: Assessment of The Commercial Building Stock In The Pacific Northwest*. Report 04-125. Prepared for Northwest Energy Efficiency Alliance. March 8, 2004.

Lawrence Berkely National Laboratory, Portland Energy Conservation Inc., and Texas A&M University. *The Cost-Effectiveness of Commercial Buildings Commissioning*. December 2004.

Marbek Resource Consultants. *Market Analysis: Roadway and Parking Area Lighting – Final Report*. Prepared for Natural Resources Canada. January 2006.

Marbek Resource Consultants. *Market Analysis: Dusk-To-Dawn Luminaires: Final Report*. Prepared for Natural Resources Canada. October 14, 2006.

Marbek Resource Consultants in association with Applied Energy Group. *2007 Conservation Potential Review: The Potential for Electricity Savings through Technology Adoption, 2006-2026 - Commercial Sector in British Columbia*, prepared for BC Hydro, November 2007.

Marbek Resource Consultants in association with CBCL Ltd. and Applied Energy Group. *2007 Conservation and Demand Management (CDM) Potential: Newfoundland and Labrador - Commercial Sector*, prepared for Newfoundland & Labrador Hydro and Newfoundland Power, January 2008.

Marbek Resource Consultants. *Natural Gas Energy Efficiency Potential.* Prepared for Union Gas, March 2009.

Marbek Resource Consultants. *Natural Gas Energy Efficiency Potential: Update 2008.* Prepared for Enbridge Gas Distribution, May 2009.

Natural Resources Canada. *Lighting Reference Guide*. 2005.

Natural Resources Canada (CETC Varennes). *Refrigeration Action Plan for Buildings: Supermarkets, Ice Rinks, Curling Rinks*. August 2003.

Navigant Consulting. *Measures and Assumptions for Demand Side Management (DSM) Planning*. Prepared for the Ontario Energy Board. April 16, 2009.

Ontario Power Authority. *2011 Quasi-Prescriptive Measures and Assumptions, Release Version 1*. December 2010.

RS Means. *Assemblies Cost Data 35th Edition*. 2010.

RS Means. *Mechanical Cost Data 32nd Edition, HVAC and Controls*. 2009.

SaskPower, Saskatchewan Parks and Recreation Association and Office of Energy Conservation. *The Energy Management Manual for Arena and Rink Operators*. February 2007.

Yukon Bureau of Statistics. *Community Spatial Price Index, April 2011*. (Available in *Yukon Monthly Statistical Review, June 2011*. http://www.eco.gov.yk.ca/stats/pdf/mr_june2011.pdf.)

Yukon Bureau of Statistics. *2009 Annual Report*. October 2010.

12 Glossary

Achievable Potential:

The portion of the economic conservation potential that is achievable through government and utility interventions and programs given institutional, economic, and market barriers.

Activity-Based Potential:

- **Operations:** Monitoring and adjustment of system controls to optimise the operation and minimize the energy use of energy-using systems
- **Maintenance:** Regular cleaning and adjustment to optimize the performance of energy-using systems
- **Behaviour:** Actions of personnel to habitually save energy within their daily routine.

Avoided Cost:

By reducing energy consumption and capacity requirements through the implementation of demand-side management programs, the Yukon utilities avoid the cost of having to buy energy on the open market, contract for long term supply, and/or build and run new generation facilities. This avoided cost is used to develop a benchmark against which the cost of energy efficiency measures can be compared.

Base Year:

The Base Year for the 2011 CPR is the 2010 sales for the two utilities. This number is derived from 2010 sales and forecast 2010 energy and capacity requirements as is explained in each report.

Benchmark for Economic Analysis:

The study established benchmarks for the economic cut-off for new avoided electrical supply on each of the four different supply systems in Yukon. These values were selected to provide the CPR with a reasonably useful time horizon (life) to allow planners to examine options that may become more cost-effective over time. The following values were used:

- Residential accounts on the hydro grid: $0.35/kWh
- Residential accounts on large diesel and small diesel systems: $0.30/kWh
- Residential accounts on the Old Crow system: $0.64/kWh.

Cost of Conserved Energy (CCE):

The CCE is calculated for each energy-efficiency measure. The CCE is the annualized incremental capital and operating and maintenance (O&M) cost of the upgrade measure divided by the annual energy savings achieved, excluding any administrative or program costs. The CCE represents the cost of conserving one kWh of electricity; it can be compared directly to the cost of supplying one new kWh of electricity.

Cost of Electric Peak Reduction (CEPR):

The CEPR for a peak load reduction measure is defined as the annualized incremental capital and O&M cost of the measure divided by the annual peak reduction achieved, excluding any administrative or program costs. The CEPR represents the cost of reducing one kW of electricity during a peak period; it can be compared to the cost of supplying one new kW of electric capacity during the same period.

Demand-side Management (DSM):
DSM is the influencing of customers' electricity use to obtain desirable and quantifiable changes in that use. For example, DSM comprises such cooperative joint customer and utility initiatives as peak clipping, valley filling, load shifting, strategic conservation, strategic load growth, flexible load shape, customer on-site generation and other similar activities.

Economic Efficiency:
This is the allocation of human and natural resources in a way that results in the greatest net economic benefit, regardless of how benefits and costs are distributed within society.

Economic Potential:
The Economic Potential is the savings in electricity consumption due to energy-efficient measures whose Cost of Conserved Energy (CCE) is less than or equal to the benchmark for economic analysis.

Effective Measure Life (EML):
The estimated median number of years that the measures installed under a program are still in place and operable. EML incorporates: field conditions, obsolescence, building remodelling, renovation, demolition and occupancy changes.

Electricity Audit:
An on-site inspection and cataloguing of electricity-using equipment/buildings, electricity consumption, and the related end uses. The purpose is to provide information to the customer and the utility. Audits are useful for load research, for DSM program design and identifying specific energy savings projects.

Electric Capacity:
The maximum electric power that a device or network is capable of producing or transferring.

Electricity Conservation:
Activities by utilities or electricity users that result in a reduction of electric energy use without adversely affecting the level or quality of energy service provided. Electricity conservation measures include substitution of high-efficiency motors for standard efficiency ones, occupancy sensors in office buildings, insulation in residences, etc.

Electricity Efficiency:
The ratio of the useful energy delivered by a dynamic system to the amount of electric energy supplied to it.

Electric Energy:
Energy in the form of electricity. Energy is the ability to perform work. Electric energy is different from electric power. Electric energy is measured in kilowatt-hours, megawatt-hours or gigawatt-hours.

Electricity Intensity:
Electric energy use measured per application or end use. Examples would include kilowatt-hours per square meter of lit office space per day, kilowatt-hours per tonne of potash produced, and kilowatt-hours per year per residential refrigerator. Electricity intensity increases as electricity efficiency decreases.

Electric Power:
The rate at which electric energy is produced or transferred, usually measured in watts, kilowatts and megawatts.

End use:
The services of economic value to the users of energy. For example, office lighting is an end use, whereas electricity sold to the office tenant is of no value without the equipment (light fixtures, wiring, etc.) necessary to convert the electricity into visible light. End use is often used interchangeably with energy service.

Energy Service:
An amenity or service supplied jointly by energy and other components such as buildings, motors and lights. Examples of energy services include residential space heating, commercial refrigeration, natural gas production, and lighting. The same energy service can frequently be supplied with different mixes of equipment and energy.

Financial Incentive:
Certain financial features in the utility's demand-side management programs designed to motivate customer participation. These may include features designed to reduce a customer's net cash outlay, payback period or cost of finance to participate in a specific demand-side management measure or technology.

Flexible Load Shape:
This is utility action to present customers with variations in service quality in exchange for incentives. Programs involved may be variations of interruptible or curtail-able load, concepts of pooled, integrated energy management systems, or individual customer load control devices offering service constraints.

Gigawatt-hour (GWh):
One gigawatt-hour is one million kilowatt-hours.

Integrated Planning:
See Supply Planning.

Integrated Electricity Planning (IEP):
See Supply Planning.

Kilowatt (kW):
One kilowatt is one thousand watts; this is the basic unit of measurement of electric energy. One kilowatt-hour represents the power of one thousand watts (one kilowatt) for a period of one hour. A typical non-electrically heated detached home in Yukon uses about 12,800 kWh per year. A four foot fluorescent lamp in an office might use about 100-200 kWh per year and a large coal-fired plant might produce about three billion kWh per year.

Load Forecast:
The forecast of electricity demand over a specified time period. Long-term load forecasts usually pertain to a 10- to 20-year period. In the case of Yukon, the load forecast assumes a specific set of rates or prices for electricity and competing energy forms, as well as many other economic variables. In addition, forecasts of electricity conserved through DSM programs are incorporated into the Supply Planning process.

Load Research:
Research to disaggregate and analyze patterns of electricity consumption by various sub sectors and end use is defined as load research. Load research supports the development of the load forecast and the design of demand-side management programs.

Load Shape:
The time pattern and magnitude of a utility's electrical demand.

Load Shifting:
Utility program activity to shift demand from peak to off-peak periods is defined as load shifting.

Measure Total Resource Cost (TRC):
The measure TRC calculates the net present value of energy savings that result from an investment in an energy-efficiency measure. The measure TRC is equal to its full or incremental capital cost (depending on application) plus any change (positive or negative) in the combined annual energy and O&M costs. This calculation includes, among others, the following inputs: the avoided electricity supply costs, the life of the technology, and the selected discount rate, which in this analysis has been set at 5.25%.
A measure with a positive measure TRC value is included in subsequent stages of the analysis, which consists of the Economic and Achievable Potential scenarios. A measure with a negative TRC value is not economically attractive and is therefore not included in subsequent stages of the analysis.

Megawatt (MW):
One thousand kilowatts.

"Natural" Change in Electricity Intensity:
The future change in electricity intensity in a given end use that is expected to occur in the absence of demand-side management programs. In developing an estimate of natural change in electricity intensity it is necessary to make an explicit assumption about the future prices of electricity and competing fuels.

Peak Clipping:
Utility program activity to reduce peak demand without reducing demand at other times of the day or year.

Peak Demand:
Peak demand is the maximum electric power required by a customer or electric system during a short time period, typically one hour. The peak is the time (usually of day or year) at which peak demand occurs.

Rate Structure:
The formulas used to calculate charges for the use of electricity. For example, the present rate structures for both Yukon utilities for residential customers consist of a fixed monthly charge and charges for electric energy usage, where the rate per kilowatt-hour depends on the level of consumption. Some rate structures charge for peak usage as well as energy usage.

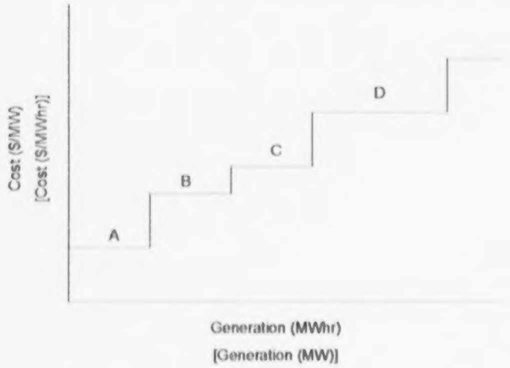
Reference Case:
Provides a forecast of electricity sales that includes natural conservation (that which would occur in the absence of DSM programs) but no impacts of utility DSM programs. The Reference Case for the study is based on the 2010 YECL Load Forecast.

Sector:
A group of customers having a common type of economic activity.

Sub sectors:
A classification of customers within a sector by common features. Residential sub sectors are by type of home (single family dwelling or apartment). Commercial sub sectors are generally by type of commercial service (i.e., Food Retail or Office).

Supply Curves:

A graph that depicts the volume of energy at the appropriate screened price in ascending order of cost. Steps A through D below represent programs options, or technologies arranged as a supply curve.



Supply Planning:

The process of long-term planning of electricity generation and associated transmission facilities, in combination with supply reductions made possible through demand-side management, in order to meet forecast demands. Supply Planning in Yukon is done in a framework that recognizes economic, financial, environmental and social costs, risks, and impacts.

Supply System:

Electricity is supplied by YEC and YECL to customers using four different supply systems, which vary in terms of retail rates and generation costs. The four different systems are as follows:

- **Hydro grid:** All customers of YEC and most customers of YECL are connected to a grid that is served primarily by hydroelectricity
- **Large diesel:** YECL customers in Watson Lake are served by a large diesel grid
- **Small diesel:** YECL customers in Destruction Bay/Burwash, Beaver Creek, and Swift River are served by three small diesel grids
- **Old Crow:** YECL customers in Old Crow are served by a diesel grid for which the fuel must be flown into the community.

Technical Efficiency:

Efficiency of a system, process, or device in achieving a certain purpose, measured in terms of the physical inputs required to produce a given output. In the context of electricity conservation the relevant input is electric energy.

Technology-Based Potential:

Energy and or capacity/demand savings realized through the implementation of energy-efficiency technologies.

Watt:

The basic unit of measurement of electric power.

Yukon Service Area:
Yukon Service Area is the territory of Yukon. This includes all customers served by YEC or YECL, including those connected to the hydro grid as well as customers on the large and small diesel supply systems and the system serving the fly-in community of Old Crow.

Yukon Electricity Conservation and Demand Management Potential Review (CPR 2011)

Commercial Sector - Appendices

9 January 2012

Submitted to:
Yukon Energy, Yukon Electrical Company,
Government of Yukon

Submitted by:
ICF Marbek
300-222 Somerset Street West
Ottawa, Ontario K2P 2G3

Tel: +1 613 523-0784
Fax: +1 613 523-0717
info@marbek.ca
www.marbek.ca

[This page intentionally left blank.]

Table of Contents

Appendix A Background-Section 3: Base Year Electricity Use A-1

Appendix B Background-Section 4: Base Year Peak Load B-1

Appendix C Background-Section 5: Reference Case Electricity Use........ C-1

Appendix D Background-Section 6: Reference Case Peak Load D-1

Appendix E Background-Section 7: Technology Assessment - Energy-efficiency Measures E-1

Appendix F Background-Section 8: Economic Potential - Electric Energy Forecast........ F-1

Appendix G Background-Section 9: Technology Assessment - Peak Load Measures G-1

Appendix H Background-Section 10: Achievable Potential - Electric Energy Forecast........ H-1

Appendix A Background-Section 3: Base Year Electricity Use

Introduction

Appendix A provides additional detailed information related to the generation of the Commercial sector Base Year profile. The appendix discusses the following:

- Sub sector descriptions
- Sales data analysis
- CEEAM archetype summaries – existing buildings.

A1 Sub Sector Descriptions

Exhibit A 1 presents brief descriptions of the Commercial sub sectors. Detailed building archetype profiles for each sub sector are provided in Appendix A 3 (Existing buildings) and Appendix C 3 (New buildings).

Exhibit A 1 Sub sector Descriptions

Sub Sector	Definition	Examples of Building Types
Office	Buildings used for office or public administration.	Municipal Office, Government Office Building, Private Office Buildings
Food Retail	Retail store that primarily sells food items and has a significant refrigeration load.	Supermarket
Non-Food Retail	Retail store which primarily sells non-food items	"Big box" store, strip mall, enclosed mall unit
Hotel/Motel	Hotel or motel building.	
Healthcare	Buildings used for providing multiple accommodations for short- or long-term care residents.	Hospital, Nursing Homes, Nursing Stations
Recreation Centre	Community centres, typically incorporating arenas or curling rink. May include support facilities such as a community hall.	Hockey Arena, curling rink
Education	Buildings whose primary function is education. Typically characterized by seasonably variable occupancy.	Elementary or secondary schools, Universities, Colleges.
Restaurant	Full service or quick service restaurant	
Warehouse / Wholesale	Typically metal-clad building with high ceilings and predominantly high-bay lighting.	
Other General Service Building	Commercial, institutional, manufacturing or light industrial buildings which do not fit the above categories	Service garages, religious buildings, theaters, prisons, light manufacturing, placer mines.
Non-Building	Structures for which electricity is primarily used by unique equipment.	Telephone exchange, microwave repeater station.

Sub Sector	Definition	Examples of Building Types
Street Lighting	Street lighting	n/a
Parking Lot Plug	Outdoor receptacles provided in parking lots for use with block heaters	n/a

A2 Sales Data Analysis

This section outlines the methodology for the allocation of the sales data provided by YEC and YECL to the Commercial sub sectors identified above.

Both YEC and YECL provided sales data to ICF Marbek. These data included monthly consumption for accounts grouped by Standard Industrial Classification (SIC) code, rate class and supply type. These sales data were sorted using these three categories, resulting in an aggregated sales data figure (and number of accounts) for each unique combination of sub sector (using SIC code data), region (using supply type data) and ownership (government/non-government, using rate class data). Because the three diesel regions have relatively few commercial accounts, it was agreed that instead of reporting at the sub sector level, data and results would be reported in the following aggregate categories: General Service Buildings, Non-buildings and Street Lighting. Government and non-government customers are tracked separately.

Exhibit A 2, below, describes how SIC codes were mapped to the sub sector definitions given above. The available SIC code information did not allow the Food Retail and Non-food Retail sub sectors to be distinguished from each other. Instead, YEC and YECL staff manually identified individual accounts associated with food retail buildings.

Exhibit A 2 Sales Data Subsector Assignments

SIC Code	SIC Sub Sector	Description	CPR Subsector Assignment
11010	Single Family/Row	Overhead	Residential
11020	Single Family/Row	Underground	Residential
11030	Detached Garage	Detached Garage	Residential
12010	Mobile	Overhead	Residential
12020	Mobile	Underground	Residential
13010	Apartment/Bulk	Overhead	Residential
13020	Apartment/Bulk	Underground	Residential
14010	Apartment Suite	Overhead	Residential
14020	Apartment Suite	Underground	Residential
21010	Hospital	General Hospitals	Healthcare
21020	Hospital	Nursing Homes, Seniors Homes	Healthcare
21090	Hospital	Other	Healthcare
22010	Education	Elementary Schools	Education
22020	Education	High Schools	Education
22030	Education	Post Secondary Schools	Education
22090	Education	Other	Education
23010	Retail Independent	Stores - independent	Retail

SIC Code	SIC Sub Sector	Description	CPR Subsector Assignment
23020	Retail Independent	Shopping Centre - common service meter	Retail
23090	Retail Independent	Shopping Centre - bulk meter	Retail
23110	Automotive	Service stations	Other General Service Buildings
23120	Automotive	Car dealerships	Other General Service Buildings
23130	Automotive	Parking lot plug ins	Parking Lot Plug
23190	Automotive	Other	Other General Service Buildings
24010	Wholesale	Farm implement and equipment	Warehouse / Wholesale
24020	Wholesale	Lumber and building materials	Warehouse / Wholesale
24090	Wholesale	Other	Warehouse / Wholesale
24110	Warehouse	Grain elevators, seed cleaning plants	Warehouse / Wholesale
24120	Warehouse	Transportation Vehicle Storage	Warehouse / Wholesale
24190	Warehouse	Other	Warehouse / Wholesale
25010	Office	Less than 3 storey	Office
25020	Office	More than 3 storey	Office
26010	Transportation/Communications	Transportation	Other General Service Buildings
26020	Transportation/Communications	Communications	Non-Buildings
26030	Utilities/Defense	Utilities	Non-Buildings
26040	Utilities/Defense	Defense	Non-Buildings
26090	Utilities/Defense	Other	Non-Buildings
27010	Accommodations and Food Services	Hotel	Hotel / Motel
27020	Accommodations and Food Services	Motel	Hotel / Motel
27030	Accommodations and Food Services	Restaurant	Restaurant
27090	Accommodations and Food Services	Other	Restaurant
28010	Community, Recreational, Social and Religious Centres	Curling rinks	Recreation Centres
28020	Community, Recreational, Social and Religious Centres	Arenas (Rec centres)	Recreation Centres
28030	Community, Recreational, Social and Religious Centres	Motion picture theatres	Other General Service Buildings
28040	Community, Recreational, Social and Religious Centres	Community Halls	Other General Service Buildings
28090	Community, Recreational, Social and Religious Centres	Other	Other General Service Buildings
29010	Miscellaneous	Cathodic protection and rectifiers	Non-Buildings
29030	Miscellaneous	Construction: apt/condo	Other General Service Buildings
29032	Miscellaneous	Common service apartment	Residential
29040	Miscellaneous	Construction: non-resid.	Other General Service Buildings
29041	Miscellaneous	Construction: non-resid. Temporary	Other General Service Buildings
29050	Miscellaneous	Construction trades	Other General Service Buildings

SIC Code	SIC Sub Sector	Description	CPR Subsector Assignment
29051	Miscellaneous	Welding shops	Other General Service Buildings
29060	Miscellaneous	Unoccupied space	Non-Buildings
29070	Miscellaneous	Small oilfield service	Other General Service Buildings
29080	Miscellaneous	Penitentiary/jail	Other General Service Buildings
29090	Miscellaneous	Other	Non-Buildings
29091	Miscellaneous	Large company farm	Other General Service Buildings
31010	Residential Street Lighting	Overhead	Street Lighting
31020	Residential Street Lighting	Underground	Street Lighting
32010	Highway Street Lighting	Overhead	Street Lighting
32020	Highway Street Lighting	Underground	Street Lighting
67010	Industrial	Sawmills	Other General Service Buildings
67510	Industrial	Cement	Other General Service Buildings
68090	Industrial	Other Mining	Other General Service Buildings
69090	Industrial	Other Manufacturing	Other General Service Buildings
81010	Sentinel Lighting	Overhead	Street Lighting
81020	Sentinel Lighting	Underground	Street Lighting

A3 CEEAM Archetype Summaries – Existing Buildings

This section includes summary profiles of the nine new building archetypes constructed for this study. Exhibit C 12 presents a table of contents for the CEEAM building profiles that follow. A glossary of terms and acronyms used in the building profiles is included at the end of this appendix.

Exhibit A 3 Table of Contents - Existing CEEAM Building Profiles

Sub Sector	Page #
Office	A – 6
Food Retail	A – 11
Non-food Retail	A – 16
Hotel / Motel	A – 21
Healthcare	A – 26
Education	A – 31
Restaurant	A – 36
Recreation Centres	A – 41
Warehouse / Wholesale	A – 46
Terms Used in Building Profiles	A – 51

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Office	< 40,000 ft2		Yukon
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F	
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F	
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F	
Window/Wall Ratio (WIWAR) (%)	0.35				
Shading Coefficient (SC)	0.58				

Typical Building Size	1,394	m²	15,000	ft²
Typical Footprint (m²)	697	m²	7,500	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	75%				25%				100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 9.87%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation L/s.m² CFM/ft²
operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	2.98	L/s.m²	0.59	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	282,237	
Peak Zone Sensible Load	189,275	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	8,805	
Total air circulation or Design air	2.98	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Office	**< 40,000 ft2**		**Yukon**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	14.2	W/m^2	1.3	W/ft^2
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	450	500	650					Total
% Distribution		100%						100%
Weighted Average								500
	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50%		50%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	4.4
	MJ/m^2.yr	171

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	33.3	W/m^2	3.1	W/ft^2
Occ. Period(Hrs./yr.)	3200			
Unocc. Period(Hrs./yr.)	5560			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	30%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	200	300	400	500				Total
% Distribution	10%	40%	40%	10%				100%
Weighted Average								350
	INC	CFL	T12	T8	MH	HPS	Other	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.55	0.55	0.55	
Efficacy (L/W)	15	50	72	84	65	90	90	

EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	56

EUI = Load X Hrs. X SF X GLFF

HIGH BAY LIGHTING

Light Level		Lux		ft-candles
Floor Fraction (HBLFF)				
Connected Load		W/m^2		W/ft^2
Occ. Period(Hrs./yr.)	4000			
Unocc. Period(Hrs./yr.)	4760			
Usage During Occupied Period	0%			
Usage During Unoccupied Period	100%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00	1.00

Light Level (Lux)	300	500	700	1000				Total
% Distribution								
Weighted Average								
	INC	CFL	T12	T8		MH	HPS	TOTAL
System Present (%)								
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	
	MJ/m^2.yr	

TOTAL LIGHTING

Overall LP 16.09 W/m^2

EUI TOTAL	kWh/ft^2.yr	5.9
	MJ/m^2.yr	227

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.06			
Connected Load	1.9	W/m^2	1.8	W/m^2	0.6	W/m^2	0.8	W/m^2	0.5	W/m^2	1.5	W/m^2
	0.2	W/ft^2	0.2	W/ft^2	0.05	W/ft^2	0.07	W/ft^2	0.05	W/ft^2	0.14	W/ft^2
Diversity Occupied Period	80%		80%		80%		80%		100%		80%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		2500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		6260	

Total end-use load (occupied period)	5.8	W/m^2	0.5	W/ft^2
Total end-use load (unocc. period)	3.8	W/m^2	0.4	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	66%			

Computer Equipment	EUI	kWh/ft^2.yr	2.77
		MJ/m^2.yr	107.44
Plug Loads	EUI	kWh/ft^2.yr	0.72
		MJ/m^2.yr	27.70

FOOD SERVICE EQUIPMENT

Provide description below: Fossil Fuel Share: 5.0% Electricity Fuel Share: 95.0%

Lunch room/cafeteria/restaurant

Fossil Fuel EUI			All Electric EUI		
EUI	kWh/ft^2.yr	0.1	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0		MJ/m^2.yr	4.0

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	4.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.5
	MJ/m^2.yr	20

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Office	**< 40,000 ft2**		**Yukon**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers		Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High						
System Present (%)	30%	30%	10%	10%	10%		10%	100%
Eff./COP	75%	80%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load	96.7	W/m^2	30.7	Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load)	739	MJ/m^2.yr	19.1	kWh/ft^2.yr
Sizing Factor	1.00			
Electric Fuel Share	30.0%	Fossil Fuel Share	70.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	13.8
MJ/m^2.yr	534

Fossil Fuel EUI	
kWh/ft^2.yr	24.7
MJ/m^2.yr	958

Market Composite EUI	
kWh/ft^2.yr	21.5
MJ/m^2.yr	831

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)		25.0%			75.0%			100.0%
COP	4.7	5.4	3.5	3.5	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	59	W/m^2	19	Btu/hr.ft^2	638	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	51.5	MJ/m^2.yr	1.3	kWh/ft^2.yr		

Sizing Factor 1.00

Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 75.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	22

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	22

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Tank				Boiler
System Present (%)	50%				
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.65		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	25

Fossil Fuel EUI	
kWh/ft^2.yr	0.9
MJ/m^2.yr	35

Market Composite EUI	
kWh/ft^2.yr	0.8
MJ/m^2.yr	30.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Office	**< 40,000 ft2**		**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.0	L/s.m^2	0.59	CFM/ft^2
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	3.4	W/m^2	0.31	W/ft^2
Fan Design Load VAV	3.4	W/m^2	0.31	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	75%	25%	100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit area	0.3	L/s.m^2	0.06	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.4	L/s.m^2	0.08	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.17	W/m^2	0.11	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m^2	0.005	U.S. gpm/ft^2
Pump Head Pressure	90	kPa	30	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.57	W/m^2	0.05	W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0038	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.4	W/m^2	0.04	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	17.0	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m^2.yr
Condenser Pump Energy Consumption	0.2	kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m^2.yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.7	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	2.0
	MJ/m^2.yr	76.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:
Office
Baseline

SIZE:
< 40,000 ft2

VINTAGE:

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 17.4 kWh/ft^2·yr 675.7 MJ/m^2·yr **Fossil Fuel** 17.8 kWh/ft^2·yr 688.7 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	4.4	170.6
ARCHITECTURAL LIGHTING	1.5	56.5
HIGH BAY LIGHTING		
OTHER PLUG LOADS	0.7	27.7
HVAC FANS & PUMPS	2.0	76.1
REFRIGERATION	0.1	4.0
MISCELLANEOUS	0.5	20.0
COMPUTER EQUIPMENT	2.8	107.4
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	4.1	160.1	17.3	670.9
SPACE COOLING	0.4	16.2		
DOMESTIC HOT WATER	0.3	12.5	0.5	17.5
FOOD SERVICE EQUIPMENT	0.1	3.8	0.0	0.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Yukon**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.06			
Shading Coefficient (SC)	0.69			

Typical Building Size	2,788	m²	30,000	ft²
Typical Footprint (m²)	2,788	m²	30,000	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	1			
Floor to Floor Height (m)	4.6	m	15.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	35	L/s.person	74	CFM/person

%OA 27.28%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % F.A. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1.5			
Total Air Circulation or Design Air Flow	2.85	L/s.m²	0.56	CFM/ft²
Infiltration Rate	0.70	L/s.m²	0.14	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	680,897	
Peak Zone Sensible Load	241,371	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	11,229	
Total air circulation or Design air	2.85	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail			Yukon
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.45			
Connected Load	13.6	W/m^2	1.3	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Light Level (Lux)	300	500	700	1000	Total
% Distribution		100%			100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)			50%		50%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI		
	kWh/ft^2.yr	3.0
	MJ/m^2.yr	116

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	60.4	W/m^2	5.6	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Light Level (Lux)	300	500	700	1000	Total
% Distribution		100%			100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	75%	25%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft^2.yr	3.0
	MJ/m^2.yr	115

HIGH BAY LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.45			
Connected Load	23.0	W/m^2	2.1	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	20%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution		100%			100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						95%	5%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI		
	kWh/ft^2.yr	5.1
	MJ/m^2.yr	197

TOTAL LIGHTING

Overall LP 22.55 W/m^2

EUI TOTAL		
	kWh/ft^2.yr	11
	MJ/m^2.yr	428

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.65	0.65	0.01	0.01	0.03	
Connected Load	0.8 W/m^2	0.7 W/m^2	0.0 W/m^2	0.0 W/m^2	0.1 W/m^2	1.5 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.01 W/ft^2	0.14 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	4660

Total end-use load (occupied period)	2.9	W/m^2	0.3	W/ft^2
Total end-use load (unocc. period)	1.7	W/m^2	0.2	W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	58%

	EUI		
Computer Equipment	EUI	kWh/ft^2.yr	0.88
		MJ/m^2.yr	34.0
Plug Loads	EUI	kWh/ft^2.yr	0.84
		MJ/m^2.yr	32.5

FOOD SERVICE EQUIPMENT

Provide description below: Fossil Fuel Share: 60.0% Electricity Fuel Share: 40.0%

	Fossil Fuel EUI		All Electric EUI
EUI	kWh/ft^2.yr	2.6	1.5
	MJ/m^2.yr	100.0	60.0

REFRIGERATION

Provide description below:

Commercial refrigeration display cases

EUI		
	kWh/ft^2.yr	31.0
	MJ/m^2.yr	1200.0

MISCELLANEOUS

EUI		
	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Food Retail
Baseline
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistanc	Total
System Present (%)	15%	15%	50%		10%		10%	100%
Eff./COP	75%	80%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load 58.3 W/m^2 18.5 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 772 MJ/m^2.yr 19.9 kWh/ft^2.yr
Sizing Factor 1.00

Electric Fuel Share 20.0% Fossil Fuel Share 80.0% Other fuel Share

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	14.0
MJ/m^2.yr	542

Fossil Fuel EUI	
kWh/ft^2.yr	26.3
MJ/m^2.yr	1017

Market Composite EUI	
kWh/ft^2.yr	23.8
MJ/m^2.yr	922

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recip. Chiller	Pkgd. DX	Absorption Chillers W. H.	Absorption Chillers CW	Total
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load 72 W/m^2 23 Btu/hr.ft^2 529 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 24.1 MJ/m^2.yr 0.6 kWh/ft^2.yr

Sizing Factor 1.00 Operation (occ. period 4000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 65.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	11

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	11

SERVICE HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	55%				5%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	60%		40%
Blended Efficiency	0.66		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 45.5

Wetting Use Percentage 20%

All Electric EUI	
kWh/ft^2.yr	1.3
MJ/m^2.yr	50

Fossil Fuel EUI	
kWh/ft^2.yr	1.8
MJ/m^2.yr	69

Market Composite EUI	
kWh/ft^2.yr	1.6
MJ/m^2.yr	61.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Food Retail			**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.9	L/s.m^2	0.56	CFM/ft^2
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.0	W/m^2	0.28	W/ft^2
Fan Design Load VAV	3.0	W/m^2	0.28	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.01	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.03	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.43	W/m^2	0.13	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m^2	0.006	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	80%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0045	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	50	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.6	W/m^2	0.06	W/ft^2		

Supply Fan Occ. Period	5000	hrs./year
Supply Fan Unocc. Period	3760	hrs./year
Supply Fan Energy Consumption	20.4	kWh/m^2.yr
Exhaust Fan Occ. Period	5000	hrs./year
Exhaust Fan Unocc. Period	3760	hrs./year
Exhaust Fan Energy Consumption	1.6	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	3.9	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	2.4
	MJ/m^2.yr	93.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Food Retail
Baseline

Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 51.9 kWh/ft².yr 2,008.7 MJ/m².yr **Fossil Fuel** 23.6 kWh/ft².yr 915.0 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	3.0	116.5
ARCHITECTURAL LIGHTING	3.0	114.7
HIGH BAY LIGHTING	5.1	196.7
OTHER PLUG LOADS	0.8	32.5
HVAC FANS & PUMPS	2.4	93.7
REFRIGERATION	31.0	1,200.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.9	34.0
ELEVATORS		
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	2.8	108.3	21.0	813.5
SPACE COOLING	0.2	7.4		
SERVICE HOT WATER	0.5	20.0	1.1	41.5
FOOD SERVICE EQUIPMENT	0.6	24.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Non Food Retail **Yukon**
Baseline

CONSTRUCTION

Wall U value (W/m^2.°C)	0.38	W/m^2.°C	0.07	Btu/hr.ft^2.°F	
Roof U value (W/m^2.°C)	0.29	W/m^2.°C	0.05	Btu/hr.ft^2.°F	
Glazing U value (W/m^2.°C)	3.30	W/m^2.°C	0.58	Btu/hr.ft^2.°F	
Window/Wall Ratio (WIWAR) (%)	0.10				
Shading Coefficient (SC)	0.75				

Typical Building Size	929	m^2	10,000	ft^2
Typical Footprint (m^2)	929	m^2	10,000	ft^2
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	1			
Floor to Floor Height (m)	4.5	m	14.8	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m^2/person	269	ft^2/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 12.53%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m^2	0.10	CFM/ft^2
	50%	operation (%)		

Sizing Factor	0.75			
Total Air Circulation or Design Air Flow	2.39	L/s.m^2	0.47	CFM/ft^2
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.42	L/s.m^2	0.08	CFM/ft^2

Separate Make-up air unit (100% OA)		L/s.m^2		CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	198,376	
Peak Zone Sensible Load	135,162	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	6,288	
Total air circulation or Design air	2.39	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year ☐

Incidence of Annual Room Controls Maintenance ☐

Incidence of Annual HVAC Controls Maintenance ☐

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Non Food Retail			**Yukon**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	14.2	W/m^2	1.3	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	400	500	600	1000	Total
% Distribution	25%	50%	25%		100%
Weighted Average					500

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)			50%		50%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	5.1
	MJ/m^2.yr	197

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	60.4	W/m^2	5.6	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	30%	40%	30%		100%
Weighted Average					500

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	2.7
	MJ/m^2.yr	105

HIGH BAY LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	22.7	W/m^2	2.1	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	30%	40%	30%		100%
Weighted Average					500

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						90%	10%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	1.0
	MJ/m^2.yr	39

TOTAL LIGHTING

Overall LP 17.38 W/m^2

EUI TOTAL	kWh/ft^2.yr	8.8
	MJ/m^2.yr	342

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.18		0.18		0.01		0.01		0.02			
Connected Load	0.4	W/m^2	0.4	W/m^2	0.0	W/m^2	0.1	W/m^2	0.1	W/m^2	1.15	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2	0.01	W/ft^2	0.01	W/ft^2	0.11	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		4660	

Total end-use load (occupied period)	2.0	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	1.2	W/m^2	0.1	W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	59%

Computer Equipment	EUI	kWh/ft^2.yr	0.54
		MJ/m^2.yr	20.81
Plug Loads	EUI	kWh/ft^2.yr	0.64
		MJ/m^2.yr	24.92

FOOD SERVICE EQUIPMENT

Provide description below: Fossil Fuel Share: Electricity Fuel Share: 100.0%

Small restaurants, food courts, kitchenettes

	Fossil Fuel EUI		All Electric EUI	
EUI	kWh/ft^2.yr	0.4	kWh/ft^2.yr	0.3
	MJ/m^2.yr	15.0	MJ/m^2.yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft^2.yr	0.4
	MJ/m^2.yr	15.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Non Food Retail			**Yukon**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				Total
	Boilers		Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	
	Stan.	High						
System Present (%)	10%	5%	65%		10%		10%	100%
Eff./COP	75%	80%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load	75.9	W/m^2	24.1	Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load)	577	MJ/m^2.yr	14.9	kWh/ft^2.yr
Sizing Factor	1.00			
Electric Fuel Share	20.0%	Fossil Fuel Share	80.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	10.6
MJ/m^2.yr	411

Fossil Fuel EUI	
kWh/ft^2.yr	19.8
MJ/m^2.yr	766

Market Composite EUI	
kWh/ft^2.yr	17.9
MJ/m^2.yr	695

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.8	5.4	4.4	3.7	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.27	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	63	W/m^2	20	Btu/hr.ft^2	605	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	42.6	MJ/m^2.yr	1.1	kWh/ft^2.yr		
Sizing Factor	1.00					
A/C Saturation (Incidence of A/C)	65.0%					
Electric Fuel Share	100.0%	Gas Fuel Share				

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

All Electric EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	10

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	10

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	70%				
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	70%		30%
Blended Efficiency	0.65		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load)	17.3
Wetting Use Percentage	90%

All Electric EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	19

Fossil Fuel EUI	
kWh/ft^2.yr	0.7
MJ/m^2.yr	27

Market Composite EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	24.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Non Food Retail			Yukon
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.4	L/s.m^2	0.47	CFM/ft^2
System Static Pressure CAV	400	Pa	1.6	wg
System Static Pressure VAV	400	Pa	1.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	1.8	W/m^2	0.17	W/ft^2
Fan Design Load VAV	1.8	W/m^2	0.17	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.04	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.25	W/m^2	0.12	W/ft^2

Condenser Pump

Pump Design Flow		L/s.KW		U.S. gpm/Ton
Pump Design Flow per unit floor area		L/s.m^2		U.S. gpm/ft^2
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0040	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	12.9	kWh/m^2.yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	2.0	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	1.4
	MJ/m^2.yr	54.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Non Food Retail
Baseline
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 15.6 kWh/ft^2.yr 605.1 MJ/m^2.yr **Fossil Fuel** 16.3 kWh/ft^2.yr 631.5 MJ/m^2.yr

END USE:	kWh/ft^2.yr	MJ/m^2.yr
GENERAL LIGHTING	5.1	197.3
ARCHITECTURAL LIGHTING	2.7	105.2
HIGH BAY LIGHTING	1.0	39.4
OTHER PLUG LOADS	0.6	24.9
HVAC FANS & PUMPS	1.4	54.1
REFRIGERATION	0.4	15.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	20.8
ELEVATORS/ESCALATORS		
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2.yr	MJ/m^2.yr	kWh/ft^2.yr	MJ/m^2.yr
SPACE HEATING	2.1	82.3	15.8	612.9
SPACE COOLING	0.2	6.5		
DOMESTIC HOT WATER	0.1	5.7	0.5	18.6
FOOD SERVICE EQUIPMENT	0.3	10.0		

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hotel/Motel	< 40,000 ft2		Yukon
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.57			

Typical Building Size	1,859	m²	20,000	ft²
Typical Footprint (m²)	929	m²	10,000	ft²
Footprint Aspect Ratio (L:W)	4			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.2	m	10.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	90%				10%				100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	46	m²/person	495	ft²/person	%OA	7.93%
Occupancy Schedule Occ. Period	50%					
Occupancy Schedule Unocc. Period	80%					
Fresh Air Requirements or Outside Air	8	L/s person	16	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)	1	If Fresh Air Control Type = "2" enter % FA. to the right.	15%			
		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	2.06	L/s.m²	0.40	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	1.00	L/s.m²	0.20	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	238,677	
Peak Zone Sensible Load	174,088	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	8,099	
Total air circulation or Design air	2.06	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	15	°C	59	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hotel/Motel	< 40,000 ft2		Yukon
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	12.8	W/m²	1.2	W/ft²

Occ. Period(Hrs./yr.)	4400
Unocc. Period(Hrs./yr.)	4360
Usage During Occupied Period	85%
Usage During Unoccupied Period	15%

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	200	300	400	500			Total
% Distribution			50%	50%			100%
Weighted Average							450

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50%		50%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	1.3
	MJ/m².yr	50

ARCHITECTURAL LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	11.9	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	2500
Unocc. Period(Hrs./yr.)	6260
Usage During Occupied Period	50%
Usage During Unoccupied Period	25%

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	100	125	150	300			Total
% Distribution	25%	50%	25%				100%
Weighted Average							125

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	2.3
	MJ/m².yr	90

HIGH BAY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)				
Connected Load	14.0	W/m²	1.3	W/ft²

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

Light Level (Lux)	300	500	700	1000			Total
% Distribution	100%						100%
Weighted Average							300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)		0%				100%	0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft².yr	
	MJ/m².yr	

TOTAL LIGHTING

Overall LP 12.12 W/m²

EUI TOTAL	kWh/ft².yr	3.6
	MJ/m².yr	141

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.02			
Connected Load	0.4	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.1	W/m²	1.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.01	W/ft²	0.14	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2500		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6260		5760	

Total end-use load (occupied period)	2.0	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	1.0	W/m²	0.1	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	48%

Computer Equipment	EUI	kWh/ft².yr	0.55
		MJ/m².yr	21.19
Plug Loads	EUI	kWh/ft².yr	0.49
		MJ/m².yr	19.12

FOOD SERVICE EQUIPMENT

Provide description below:

Kitchen services

Fossil Fuel Share: 75.0%

Electricity Fuel Share: 25.0%

Fossil Fuel EUI		
EUI	kWh/ft².yr	2.6
	MJ/m².yr	100.0

All Electric EUI		
EUI	kWh/ft².yr	1.3
	MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Hotel/Motel Baseline
SIZE: < 40,000 ft2
VINTAGE:
REGION: Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	50%	10%	20%				20%	100%
Eff./COP	75%	80%	70%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.43	0.59	0.33	0.22	1.00	

Peak Heating Load 90.4 W/m^2 28.7 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 635 MJ/m^2.yr 16.4 kWh/ft^2.yr
Sizing Factor 1.00
Electric Fuel Share 20.0% Fossil Fuel Share 80.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	16.4
MJ/m^2.yr	635

Fossil Fuel EUI	
kWh/ft^2.yr	22.1
MJ/m^2.yr	855

Market Composite EUI	
kWh/ft^2.yr	20.9
MJ/m^2.yr	811

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)	20.0%				80.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load 38 W/m^2 12 Btu/hr.ft^2 1006 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 32.3 MJ/m^2.yr 0.8 kWh/ft^2.yr
Sizing Factor 1.00 Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 65.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	13

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	13

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	65%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 236.6
Wetting Use Percentage 80%

All Electric EUI	
kWh/ft^2.yr	6.7
MJ/m^2.yr	260

Fossil Fuel EUI	
kWh/ft^2.yr	9.1
MJ/m^2.yr	351

Market Composite EUI	
kWh/ft^2.yr	8.7
MJ/m^2.yr	337.6

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Hotel/Motel	**< 40,000 ft2**		**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.1	L/s.m^2	0.40	CFM/ft^2
System Static Pressure CAV	338	Pa	1.4	wg
System Static Pressure VAV	338	Pa	1.4	wg
Fan Efficiency	45%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	1.9	W/m^2	0.18	W/ft^2
Fan Design Load VAV	1.9	W/m^2	0.18	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m^2	0.04	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.3	L/s.m^2	0.06	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m^2	0.04	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.88	W/m^2	0.08	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m^2	0.003	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m^2	0.0024	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.3	W/m^2	0.03	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	11.8	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.6	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m^2.yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	1.3	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	57.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hotel/Motel	< 40,000 ft2		Yukon
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: Electricity: 12.6 kWh/ft^2 yr 486.3 MJ/m^2 yr Fossil Fu 27.3 kWh/ft^2 yr 1,057.6 MJ/m^2 yr

END USE:	kWh/ft^2 yr	MJ/m^2 yr
GENERAL LIGHTING	1.3	50.4
ARCHITECTURAL LIGHTING	2.3	90.5
HIGH BAY LIGHTING		
OTHER PLUG LOADS	0.5	19.1
HVAC FANS & PUMPS	1.5	57.2
REFRIGERATION	0.8	30.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	21.2
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2 yr	MJ/m^2 yr	kWh/ft^2 yr	MJ/m^2 yr
SPACE HEATING	3.3	127.0	17.7	684.0
SPACE COOLING	0.2	8.5		
DOMESTIC HOT WATER	1.0	39.0	7.7	298.6
FOOD SERVICE EQUIPMENT	0.3	12.5	1.9	75.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Healthcare			**Yukon**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.65			

Typical Building Size	8,829	m²	95,000	ft²
Typical Footprint (m²)	1,750	m²	18,830	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	3			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	80%				20%				100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period	75%			
Fresh Air Requirements or Outside Air	50	L/s person	106	CFM/person

%OA 41.33%

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	3			
Total Air Circulation or Design Air Flow	4.03	L/s.m²	0.79	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	#######	
Peak Zone Sensible Load	540,578	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.H	13.2	ft³/lbm
Design CFM	25,148	
Total air circulation or Design air flc	4.03	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	23	°C	73.4	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Healthcare Baseline
SIZE:
VINTAGE:
REGION: Yukon

LIGHTING

GENERAL LIGHTING

Light Level 450 Lux | 41.8 ft-candles
Floor Fraction (GLFF) 0.90
Connected Load 12.5 W/m^2 | 1.2 W/ft^2

Occ. Period(Hrs./yr.) 4500
Unocc. Period(Hrs./yr.) 4260
Usage During Occupied Period 90%
Usage During Unoccupied Period 30%

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	200	300	400	500	Total
% Distribution			50%	50%	100%
Weighted Average					450

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			40%		60%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft^2.yr	5.6
	MJ/m^2.yr	216

ARCHITECTURAL LIGHTING

Light Level 350 Lux | 32.5 ft-candles
Floor Fraction (ALFF) 0.10
Connected Load 29.7 W/m^2 | 2.8 W/ft^2

Occ. Period(Hrs./yr.) 8760
Unocc. Period(Hrs./yr.)
Usage During Occupied Period 85%
Usage During Unoccupied Period

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	200	300	400	500	Total
% Distribution		50%	50%		100%
Weighted Average					350

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	40%	60%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft^2.yr	2.1
	MJ/m^2.yr	80

HIGH BAY LIGHTING

Light Level 250.00 Lux | 23.2 ft-candles
Floor Fraction (HBLFF)
Connected Load 11.9 W/m^2 | 1.1 W/ft^2

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.) 4000
Unocc. Period(Hrs./yr.) 4760
Usage During Occupied Period 100%
Usage During Unoccupied Period 100%

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%			100%
Weighted Average					250

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	15%	15%	20%		50%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft^2.yr	
	MJ/m^2.yr	

TOTAL LIGHTING

Overall LPD 14.25 W/m^2

EUI TOTAL		
	kWh/ft^2.yr	7.6
	MJ/m^2.yr	296

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	54.55	51	100	200	217	
Density (device/occupant)	0.48	0.48	0.02	0.02	0.04	
Connected Load	0.9 W/m^2	0.8 W/m^2	0.1 W/m^2	0.1 W/m^2	0.3 W/m^2	3.85 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.01 W/ft^2	0.01 W/ft^2	0.02 W/ft^2	0.36 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	25%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	4660

Total end-use load (occupied period) 5.4 W/m^2 | 0.5 W/ft^2
Total end-use load (unocc. period) 2.2 W/m^2 | 0.2 W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period 100%
Usage during unoccupied period 40%

	EUI		
Computer Equipment	EUI	kWh/ft^2.yr	1.1
		MJ/m^2.yr	43.1
Plug Loads	EUI	kWh/ft^2.yr	1.7
		MJ/m^2.yr	67.3

FOOD SERVICE EQUIPMENT

Provide description below:
Commercial food services

Fossil Fuel Share: 75.0%
Electricity Fuel Share: 25.0%

	Fossil Fuel EUI			All Electric EUI	
EUI	kWh/ft^2.yr	3.1	EUI	kWh/ft^2.yr	2.1
	MJ/m^2.yr	120.0		MJ/m^2.yr	80.0

REFRIGERATION

Provide description below:
Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI		
	kWh/ft^2.yr	0.4
	MJ/m^2.yr	15.0

MISCELLANEOUS

EUI		
	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Healthcare			**Yukon**
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)		80%	10%		5%		5%	100%
Eff./COP	75%	80%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load	43.0	W/m^2	13.6	Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load)	1644	MJ/m^2.yr	42.4	kWh/ft^2.yr
Sizing Factor	1.00			
Electric Fuel Share	10.0%	Fossil Fuel Share	90.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	30.7
MJ/m^2.yr	1188

Fossil Fuel EUI	
kWh/ft^2.yr	53.4
MJ/m^2.yr	2070

Market Composite EUI	
kWh/ft^2.yr	51.2
MJ/m^2.yr	1982

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Recip Chiller	Plgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)		50.0%			50.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.37	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	76	W/m^2	24	Btu/hr.ft^2	496	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	23.8	MJ/m^2.yr	0.6	kWh/ft^2.yr		

Sizing Factor 1.00 Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 65.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	12

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.3
MJ/m^2.yr	12

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	20%				70%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.73		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 118.3

Wetting Use Percentage 50%

All Electric EUI	
kWh/ft^2.yr	3.4
MJ/m^2.yr	130

Fossil Fuel EUI	
kWh/ft^2.yr	4.2
MJ/m^2.yr	163

Market Composite EUI	
kWh/ft^2.yr	4.1
MJ/m^2.yr	159.3

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Healthcare Baseline			Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.0	L/s.m^2	0.79	CFM/ft^2
System Static Pressure CAV	875	Pa	3.5	wg
System Static Pressure VAV	875	Pa	3.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	8.0	W/m^2	0.74	W/ft^2
Fan Design Load VAV	8.0	W/m^2	0.74	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.5	L/s.m^2	0.10	CFM/ft^2
Total Building Exhaust	0.6	L/s.m^2	0.12	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.8	W/m^2	0.08	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.024	kW/kW	0.09	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.84	W/m^2	0.17	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m^2	0.006	U.S. gpm/ft^2
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load	1.01	W/m^2	0.09	W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0048	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.7	W/m^2	0.06	W/ft^2		

Supply Fan Occ. Period	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	51.4	kWh/m^2.yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	hrs./year
Exhaust Fan Energy Consumption	6.2	kWh/m^2.yr
Condenser Pump Energy Consumption	0.8	kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	4.4	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	5.8
	MJ/m^2.yr	226.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:
Healthcare
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 22.2 kWh/ft^2.yr 859.3 MJ/m^2.yr **Fossil Fue** 54.2 kWh/ft^2.yr 2,099.5 MJ/m^2.yr

END USE:	kWh/ft^2.yr	MJ/m^2.yr
GENERAL LIGHTING	5.6	216.3
ARCHITECTURAL LIGHTING	2.1	79.7
HIGH BAY LIGHTING		
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	5.8	226.5
REFRIGERATION	0.4	15.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	1.1	43.1
ELEVATORS	0.2	7.7
OUTDOOR LIGHTING	0.9	33.9

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2.yr	MJ/m^2.yr	kWh/ft^2.yr	MJ/m^2.yr
SPACE HEATING	3.1	118.8	48.1	1,863.2
SPACE COOLING	0.2	7.9		
DOMESTIC HOT WATER	0.3	13.0	3.8	146.3
FOOD SERVICE EQUIPMENT	0.5	20.0	2.3	90.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Education Baseline			Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F	Typical Building Size	3,067	m²	33,000	ft²
Roof U value (W/m².°C)	0.30	W/m².°C	0.05	Btu/hr.ft².°F	Typical Footprint (m²)	1,533	m²	16,500	ft²
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
Window/Wall Ratio (WIWAR) (%)	0.28				Percent Conditioned Space Defined as Exterior Zone	50%			
Shading Coefficient (SC)	0.68				Typical # Stories	2			
					Floor to Floor Height (m)	3.5	m	11.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)									

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m²/person	151	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	7.5	L/s.person	16	CFM/person

%OA 23.59%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 10%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	2.27	L/s.m²	0.45	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.30	L/s.m²	0.06	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	20%		80%		100%
Switchover Point		KJ/kg	20	°C	
		Btu/lbm	68	°F	

Summary of Design Parameters		
Peak Design Cooling Load	689,754	
Peak Zone Sensible Load	317,244	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	14,758	
Total air circulation or Design air	2.27	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic	35%	90%
DDC/Pneumatic	55%	
All DDC	10%	10%
Total (should add-up to 100%)	100%	100%

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	19	°C	66.2	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year 4

Incidence of Annual Room Controls Maintenance 100.0%

Incidence of Annual HVAC Controls Maintenance 100%

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	100%
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	100%
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Education
Baseline
Yukon

LIGHTING

GENERAL LIGHTING

Light Level	420	Lux	39.0	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	11.2	W/m²	1.0	W/ft²

Occ. Period(Hrs./yr.)	2000
Unocc. Period(Hrs./yr.)	6760
Usage During Occupied Period	90%
Usage During Unoccupied Period	10%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	40%	60%			100%
Weighted Average					420

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)			40%		60%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	2.1
	MJ/m².yr	80

ARCHITECTURAL LIGHTING

Light Level	370	Lux	34.4	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	35.2	W/m²	3.3	W/ft²

Occ. Period(Hrs./yr.)	2000
Unocc. Period(Hrs./yr.)	6760
Usage During Occupied Period	90%
Usage During Unoccupied Period	10%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	65%	35%			100%
Weighted Average					370

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	0.8
	MJ/m².yr	31

HIGH BAY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	13.6	W/m²	1.3	W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	2000
Unocc. Period(Hrs./yr.)	6760
Usage During Occupied Period	90%
Usage During Unoccupied Period	10%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						90%	10%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	0.3
	MJ/m².yr	12

TOTAL LIGHTING Overall LP 12.44 W/m²

EUI TOTAL	kWh/ft².yr	3
	MJ/m².yr	123

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.16		0.16		0.02		0.02		0.01			
Connected Load	0.6	W/m²	0.6	W/m²	0.1	W/m²	0.3	W/m²	0.1	W/m²	1	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.03	W/ft²	0.01	W/ft²	0.09	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		100%	
Diversity Unoccupied Period	25%		25%		25%		25%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		2000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		6760	

Total end-use load (occupied period)	2.6	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	1.0	W/m²	0.1	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	40%

Computer Equipment	EUI	kWh/ft².yr	0.61
		MJ/m².yr	23.80
Plug Loads	EUI	kWh/ft².yr	0.50
		MJ/m².yr	19.37

FOOD SERVICE EQUIPMENT

Provide description below: Fossil Fuel Share: 50.0% Electricity Fuel Share: 50.0%

Cooking

Fossil Fuel EUI		
EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

All Electric EUI		
EUI	kWh/ft².yr	0.5
	MJ/m².yr	20.0

REFRIGERATION

Provide description below:

Coolers, freezers, pop machines

50

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10.0

MISCELLANEOUS

EUI	kWh/ft².yr	0.1
	MJ/m².yr	5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Education **Yukon**
Baseline

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	40%	40%	10%		5%		5%	100%
Eff./COP	75%	80%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.33	0.59	0.33	0.22	1.00	

100%

Peak Heating Load 55.2 W/m² 17.5 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load) 658 MJ/m².yr 17.0 kWh/ft².yr
Sizing Factor 1.00
Electric Fuel Share 10.0% Fossil Fuel Share 90.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	17.0
MJ/m².yr	658

Fossil Fuel EUI	
kWh/ft².yr	21.2
MJ/m².yr	822

Market Composite EUI	
kWh/ft².yr	21.0
MJ/m².yr	814

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recip. Chiller	Pkgd. DX	Gas Cooling Absorption	Gas Cooling Engine	Total
System Present (%)	5.0%				95.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1.8	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	0.56	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water	100%	
Condenser Water	100%	

Setpoint

	°C	°F
Chilled Water	6	42.8
Condenser Water	35	95
Supply Air	14.0	57.2

Peak Cooling Load 66 W/m² 21 Btu/hr.ft² 574 ft²/Ton
Seasonal Cooling Load (Tertiary Load) 46.1 MJ/m².yr 1.2 kWh/ft².yr
Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 5.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit	100%	2
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenanc

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.6
MJ/m².yr	21

Natural Gas EUI	
kWh/ft².yr	
MJ/m².yr	

Market Composite EUI	
kWh/ft².yr	0.6
MJ/m².yr	21

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Standard Boiler	Tank Heater	Tank Heater	Cnd. Boiler	Cnd. Water
System Present (%)			50%		
Eff./COP	75%		65%	90%	90%

	Fossil		Elec. Res.
Fuel Share	50%		50%
Blended Efficiency	0.65		0.91

100%

Service Hot Water load (MJ/m².yr) (Tertiary Load) 40.0
Wetting Use Percentage 80%

All Electric EUI	
kWh/ft².yr	1.1
MJ/m².yr	44

Fossil Fuel EUI	
kWh/ft².yr	1.6
MJ/m².yr	62

Market Composite EUI	
kWh/ft².yr	1.4
MJ/m².yr	52.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Education			Yukon
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.3	L/s.m^2	0.45	CFM/ft^2
System Static Pressure CAV	250	Pa	1.0	wg
System Static Pressure VAV	250	Pa	1.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	1.2	W/m^2	0.11	W/ft^2
Fan Design Load VAV	1.2	W/m^2	0.11	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.03	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.05	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.003	kW/kW	0.01	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.19	W/m^2	0.02	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m^2	0.005	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	60%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0042	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	30	kPa	10	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	85%					
Sizing Factor	1.0					
Pump Connected Load	0.2	W/m^2	0.02	W/ft^2		

Supply Fan Occ. Period	2200	hrs./year
Supply Fan Unocc. Period	6560	hrs./year
Supply Fan Energy Consumption	6.7	kWh/m^2.yr
Exhaust Fan Occ. Period	2200	hrs./year
Exhaust Fan Unocc. Period	6560	hrs./year
Exhaust Fan Energy Consumption	1.7	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	1.1	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	0.9
	MJ/m^2.yr	34.2

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Education			Yukon
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 8.3 kWh/ft^2·yr 322.7 MJ/m^2·yr **Fossil Fu** 20.3 kWh/ft^2·yr 785.4 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	2.1	79.5
ARCHITECTURAL LIGHTING	0.8	31.4
HIGH BAY LIGHTING	0.3	12.1
OTHER PLUG LOADS	0.5	19.4
HVAC FANS & PUMPS	0.9	34.2
REFRIGERATION	0.3	10.0
MISCELLANEOUS	0.1	5.0
COMPUTER EQUIPMENT	0.6	23.8
ELEVATORS		
OUTDOOR LIGHTING	0.2	8.5

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	1.7	65.8	19.1	739.6
SPACE COOLING	0.03	1.1		
DOMESTIC HOT WATER	0.6	22.0	0.8	30.8
FOOD SERVICE EQUIPMENT	0.3	10.0	0.4	15.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	All		Yukon
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.38	W/m^2.°C	0.07	Btu/hr.ft^2.°F
Roof U value (W/m^2.°C)	0.29	W/m^2.°C	0.05	Btu/hr.ft^2.°F
Glazing U value (W/m^2.°C)	3.30	W/m^2.°C	0.58	Btu/hr.ft^2.°F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.85			

Typical Building Size	372	m^2	4,000	ft^2
Typical Footprint (m^2)	372	m^2	4,000	ft^2
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.5	m	14.8	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	60%							40%	60%
Min. Air Flow (%)					10%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m^2/person	538	ft^2/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	17	L/s person	36	CFM/person

%OA 7.24%

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)	2	If Fresh Air Control Type = "2" enter % FA. to the right:	40%			
		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m^2	0.10	CFM/ft^2
			50%	operation (%)		

Sizing Factor	1.2			
Total Air Circulation or Design Air Flow	4.70	L/s.m^2	0.92	CFM/ft^2
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.30	L/s.m^2	0.06	CFM/ft^2

Separate Make-up air unit (100% OA)	2	L/s.m^2	0.39	CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	50%		50%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	361,902	
Peak Zone Sensible Load	66,272	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	3,083	
Total air circulation or Design air	4.70	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic	60%	90%
DDC/Pneumatic	30%	
All DDC	10%	10%
Total (should add-up to 100%)	100%	100%

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	20	°C	68	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year 4

Incidence of Annual Room Controls Maintenance 100.0%

Incidence of Annual HVAC Controls Maintenance 100%

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	100%
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	100%
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**All**		**Yukon**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.50			
Connected Load	10.0	W/m^2	0.9	W/ft^2

Occ. Period(Hrs./yr.)	4300
Unocc. Period(Hrs./yr.)	4460
Usage During Occupied Period	100%
Usage During Unoccupied Period	10%
Fixture Cleaning	
Incidence of Practice	
Interval	years

Light Level (Lux)	400	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					400

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			20%		80%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2 yr	2.2
	MJ/m^2 yr	86

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.50			
Connected Load	36.3	W/m^2	3.4	W/ft^2

Occ. Period(Hrs./yr.)	4300
Unocc. Period(Hrs./yr.)	4460
Usage During Occupied Period	100%
Usage During Unoccupied Period	10%
Fixture Cleaning	
Incidence of Practice	
Interval	years

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	75%	25%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2 yr	8.0
	MJ/m^2 yr	310

HIGH BAY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)				
Connected Load	0.0	W/m^2	0.0	W/ft^2

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%
Fixture Cleaning	
Incidence of Practice	
Interval	years

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)							0%	0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2 yr	
	MJ/m^2 yr	

TOTAL LIGHTING

Overall LP 23.16 W/m^2

EUI TOTAL	kWh/ft^2 yr	10
	MJ/m^2 yr	396

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36		0.36		0.01				0.03			
Connected Load	0.4	W/m^2	0.4	W/m^2	0.0	W/m^2		W/m^2	0.1	W/m^2	1.15	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2		W/ft^2	0.01	W/ft^2	0.11	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		4660	

Total end-use load (occupied period)	1.9	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	1.1	W/m^2	0.1	W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	59%

Computer Equipment	EUI	kWh/ft^2 yr	0.49
		MJ/m^2 yr	18.95
Plug Loads	EUI	kWh/ft^2 yr	0.64
		MJ/m^2 yr	24.92

FOOD SERVICE EQUIPMENT

Provide description below: Fossil Fuel Share: 75.0% Electricity Fuel Share: 25.0%

Cooking

Fossil Fuel EUI			All Electric EUI		
EUI	kWh/ft^2 yr	23.2	EUI	kWh/ft^2 yr	16.8
	MJ/m^2 yr	900.0		MJ/m^2 yr	650.0

REFRIGERATION

Provide description below:

Walk-ins, reach ins, fridges etc

EUI	kWh/ft^2 yr	9.0
	MJ/m^2 yr	350.0

MISCELLANEOUS

EUI	kWh/ft^2 yr	0.3
	MJ/m^2 yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant	All		Yukon
Baseline			

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric					
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total	
System Present (%)	25%		60%		5%		10%	100%	100%
Eff./COP	75%	80%	70%	90%	77%	80%	1.00		
Performance (1 / Eff.) (kW/kW)	1.33	1.25	1.43	1.11	1.30	1.25	1.00		

Peak Heating Load	91.0	W/m^2	28.9	Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load)	1973	MJ/m^2.yr	50.9	kWh/ft^2.yr
Sizing Factor	1.00			

Electric Fuel Share 15.0% Oil Fuel Share 85.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	39.3
MJ/m^2.yr	1523

Fossil Fuel EUI	
kWh/ft^2.yr	71.3
MJ/m^2.yr	2763

Market Composite EUI	
kWh/ft^2.yr	70.3
MJ/m^2.yr	2722

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	Centrifugal Chillers HE	Screw Chillers	Recip Chiller	Pkgd. DX	Gas Cooling Absorption	Gas Cooling Engine	Total
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1.8	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	0.56	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water	100%	
Condenser Water	100%	

Setpoint

Chilled Water	6	°C	42.8	°F
Condenser Water	35	°C	95	°F
Supply Air	15.0	°C	59	°F

Peak Cooling Load	285	W/m^2	90	Btu/hr.ft^2	133	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	40.4	MJ/m^2.yr	1.0	kWh/ft^2.yr		

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 65.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit	100%	2
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	19

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	19

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Standard Boiler	Tank Heater	Tank Heater	Cnd. Boiler	Water Heater
System Present (%)	10%		75%		
Eff./COP	75%	60%	65%	90%	90%

	Fossil		Elec. Res.	
Fuel Share	85%		15%	100%
Blended Efficiency	0.66		0.91	

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 400.0

Wetting Use Percentage 10%

All Electric EUI	
kWh/ft^2.yr	11.3
MJ/m^2.yr	440

Fossil Fuel EUI	
kWh/ft^2.yr	15.6
MJ/m^2.yr	604

Market Composite EUI	
kWh/ft^2.yr	15.0
MJ/m^2.yr	579.7

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**All**		**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	4.7	L/s.m^2	0.92	CFM/ft^2
System Static Pressure CAV	400	Pa	1.6	wg
System Static Pressure VAV	400	Pa	1.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	4.5	W/m^2	0.42	W/ft^2
Fan Design Load VAV	4.5	W/m^2	0.42	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.5	L/s.m^2	0.11	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.6	L/s.m^2	0.13	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	72%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m^2	0.08	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.022	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	6.30	W/m^2	0.59	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.015	L/s.m^2	0.022	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	60%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.012	L/s.m^2	0.0181	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	60%					
Pump Motor Efficiency	85%					
Sizing Factor	1.0					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	3900	hrs./year
Supply Fan Unocc. Period	4860	hrs./year
Supply Fan Energy Consumption	28.6	kWh/m^2.yr
Exhaust Fan Occ. Period	3900	hrs./year
Exhaust Fan Unocc. Period	4860	hrs./year
Exhaust Fan Energy Consumption	5.6	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.2	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	3.2
	MJ/m^2.yr	124.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**All**		**Yukon**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 38.8 kWh/ft^2 yr 1,503.0 MJ/m^2 yr **Fossil Fue** 91.3 kWh/ft^2 yr 3,537.4 MJ/m^2 yr

END USE:	kWh/ft^2 yr	MJ/m^2 yr
GENERAL LIGHTING	2.2	85.8
ARCHITECTURAL LIGHTING	8.0	309.8
HIGH BAY LIGHTING		
OTHER PLUG LOADS	0.6	24.9
HVAC FANS & PUMPS	3.2	124.0
REFRIGERATION	9.0	350.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	18.9
ELEVATORS		
OUTDOOR LIGHTING	2.8	110.3

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2 yr	MJ/m^2 yr	kWh/ft^2 yr	MJ/m^2 yr
SPACE HEATING	5.9	228.4	60.6	2,348.6
SPACE COOLING	0.3	12.4		
DOMESTIC HOT WATER	1.7	65.9	13.3	513.8
FOOD SERVICE EQUIPMENT	4.2	162.5	17.4	675.0

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **Rec Centre** **Baseline**	**SIZE:**	**VINTAGE:** Existing	**REGION:** **Yukon**

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.05			
Shading Coefficient (SC)	0.80			

Typical Building Size	2,323	m²	25,000	ft²
Typical Footprint (m²)	2,323	m²	25,000	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	1			
Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 15.77%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right				
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	1.27	L/s.m²	0.25	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	235,980	
Peak Zone Sensible Load	134,178	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 56F & 100% R	13.2	ft³/lbm
Design CFM	6,242	
Total air circulation or Design air	1.27	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	16	°C	60.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	16	°C	60.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:** Existing	**REGION:**
Rec Centre			**Yukon**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	13.6	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000			Total
% Distribution		100%					100%
Weighted Average							**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)			50%		50%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft²·yr	1.0
	MJ/m²·yr	37

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	28.6	W/m²	2.7	W/ft²
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	300	700	1000			Total
% Distribution		100%					100%
Weighted Average							**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft²·yr	0.5
	MJ/m²·yr	20

HIGH BAY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.75			
Connected Load	13.6	W/m²	1.3	W/ft²
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	200	300	400				Total
% Distribution	25%	50%	25%				100%
Weighted Average							**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						90%	10%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft²·yr	3.6
	MJ/m²·yr	139

TOTAL LIGHTING

Overall LP 4.16 W/m²

EUI TOTAL	kWh/ft²·yr	5.1
	MJ/m²·yr	196

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	54.55		51		100		200		217			
Density (device/occupant)	0.05		0.05									
Connected Load	0.1	W/m²	0.1	W/m²		W/m²		W/m²		W/m²	1	W/m²
	0.0	W/ft²	0.0	W/ft²		W/ft²		W/ft²		W/ft²	0.09	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		3500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		5260	

Total end-use load (occupied period)	1.0	W/m²	0.1	W/ft²
Total end-use load (unocc. period)	0.3	W/m²	0.0	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	30%

Computer Equipment	EUI	kWh/ft²·yr	0.05
		MJ/m²·yr	1.96
Plug Loads	EUI	kWh/ft²·yr	0.41
		MJ/m²·yr	16.07

FOOD SERVICE EQUIPMENT

Fossil Fuel Share: 10.0% | Electricity Fuel Share: 90.0%

Fossil Fuel EUI			All Electric EUI		
EUI	kWh/ft²·yr	0.6	EUI	kWh/ft²·yr	0.6
	MJ/m²·yr	25.0		MJ/m²·yr	25.0

REFRIGERATION

Provide description below:

Ice plant and auxiliaries

Artificial Ice Saturation 60.0%

EUI	kWh/ft²·yr	8.0
	MJ/m²·yr	309.9

MISCELLANEOUS

EUI	kWh/ft²·yr	0.3
	MJ/m²·yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:
Rec Centre
Baseline

SIZE:

VINTAGE: Existing

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	25%	22%	50%				3%	100%
Eff./COP	75%	90%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.11	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load 60.0 W/m^2 19.0 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 578 MJ/m^2.yr 14.9 kWh/ft^2.yr
Sizing Factor 1.00
Electric Fuel Share 3.0% Oil Fuel Share 97.0%
Space Heat Saturation (Incidence of SPC HT) 70.0%

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	14.9
MJ/m^2.yr	578

Fossil Fuel EUI	
kWh/ft^2.yr	19.1
MJ/m^2.yr	741

Market Composite EUI	
kWh/ft^2.yr	19.0
MJ/m^2.yr	736

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Recip. Chiller	Pkgd. DX	Absorption Chillers		Total
	Standard	HE				W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C		°F
Chilled Water	7	°C	44.6 °F
Condenser Water	30	°C	86 °F
Supply Air	13.0	°C	55.4 °F

Peak Cooling Load 30 W/m^2 9 Btu/hr.ft^2 1271 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 13.5 MJ/m^2.yr 0.3 kWh/ft^2.yr
Sizing Factor 1.00 Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 5.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	4

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	4

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	70%				20%
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	90%		10%
Blended Efficiency	0.67		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 90.0
Incidence of Heat recr'y 20%
Heat recr'y load share 50%
Wetting Use Percentage 50%

All Electric EUI	
kWh/ft^2.yr	2.6
MJ/m^2.yr	99

Fossil Fuel EUI	
kWh/ft^2.yr	3.5
MJ/m^2.yr	134

Market Composite EUI	
kWh/ft^2.yr	3.4
MJ/m^2.yr	130.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Rec Centre Baseline	**SIZE:**	**VINTAGE:** Existing	**REGION:** Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	1.3	L/s.m^2	0.25	CFM/ft^2
System Static Pressure CAV	300	Pa	1.2	wg
System Static Pressure VAV	300	Pa	1.2	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	0.8	W/m^2	0.07	W/ft^2
Fan Design Load VAV	0.8	W/m^2	0.07	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit area	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.04	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.60	W/m^2	0.06	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m^2	0.002	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m^2	0.0019	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m^2	0.01	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	4.9	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.6	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	0.7
	MJ/m^2.yr	25.4

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:
Rec Centre
Baseline

SIZE:

VINTAGE: Existing

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 13.49 kWh/ft^2 yr 522.7 MJ/m^2 yr **Fossil Fue** 16.2 kWh/ft^2 yr 626.3 MJ/m^2 yr

END USE:	kWh/ft^2 yr	MJ/m^2 yr
GENERAL LIGHTING	0.96	37.2
ARCHITECTURAL LIGHTING	0.51	19.9
HIGH BAY LIGHTING	3.59	139.1
OTHER PLUG LOADS	0.41	16.1
HVAC FANS & PUMPS	0.66	25.4
REFRIGERATION	4.80	185.9
MISCELLANEOUS	0.26	10.0
COMPUTER EQUIPMENT	0.05	2.0
ELEVATORS		
OUTDOOR LIGHTING	1.10	42.4

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2 yr	MJ/m^2 yr	kWh/ft^2 yr	MJ/m^2 yr
SPACE HEATING	0.31	12.1	13.0	503.3
SPACE COOLING	0.01	0.2		
DOMESTIC HOT WATER	0.26	9.9	3.1	120.5
FOOD SERVICE EQUIPMENT	0.58	22.5	0.1	2.5

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: Warehouse/Wholesale Baseline
SIZE:
VINTAGE:
REGION: Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.38	W/m².°C	0.07	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.29	W/m².°C	0.05	Btu/hr.ft².°F
Glazing U value (W/m².°C)	3.30	W/m².°C	0.58	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.05			
Shading Coefficient (SC)	0.80			

Typical Building Size	2,788	m²	30,000	ft²
Typical Footprint (m²)	2,788	m²	30,000	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	1			
Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person

%OA 21.95%

Fresh Air Control Type *(enter a 1, 2 or 3) (1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air): 1

If Fresh Air Control Type = "2" enter % FA. to the right:
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation: 0.5 L/s.m² 0.10 CFM/ft²
50% operation (%)

Sizing Factor	1			
Total Air Circulation or Design Air Flow	1.14	L/s.m²	0.22	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	287,734	
Peak Zone Sensible Load	144,629	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	6,728	
Total air circulation or Design air	1.14	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Warehouse/Wholesale			**Yukon**
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.15			
Connected Load	10.9	W/m^2	1.0	W/ft^2
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%			100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)			50%		50%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	0.6
	MJ/m^2.yr	22

ARCHITECTURAL LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	28.6	W/m^2	2.7	W/ft^2
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	300	700	1000	Total
% Distribution		100%			100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	50%	50%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.5
	MJ/m^2.yr	18

HIGH BAY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.80			
Connected Load	13.6	W/m^2	1.3	W/ft^2
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	200	300	400		Total
% Distribution	25%	50%	25%		100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)						90%	10%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	4.2
	MJ/m^2.yr	161

TOTAL LIGHTING

Overall LP 13.94 W/m^2

EUI TOTAL	kWh/ft^2.yr	5.2
	MJ/m^2.yr	202

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	54.55		51		100		200		217			
Density (device/occupant)	0.59		0.59		0.03		0.03		0.06			
Connected Load	0.3	W/m^2	0.3	W/m^2	0.0	W/m^2	0.1	W/m^2	0.1	W/m^2	1	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2	0.01	W/ft^2	0.01	W/ft^2	0.09	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		3500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		5260	

Total end-use load (occupied period)	1.7	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	0.7	W/m^2	0.1	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	44%			

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Computer Equipment	EUI	kWh/ft^2.yr	0.46
		MJ/m^2.yr	17.72
Plug Loads	EUI	kWh/ft^2.yr	0.41
		MJ/m^2.yr	16.07

FOOD SERVICE EQUIPMENT

Fossil Fuel Share:

Electricity Fuel Share: 100.0%

Fossil Fuel EUI		
EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0

All Electric EUI		
EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	4.0

REFRIGERATION

Provide description below:

Process

EUI	kWh/ft^2.yr	1.8
	MJ/m^2.yr	70.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:
Warehouse/Wholesale
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	 High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistanc	Total
System Present (%)	25%	20%	50%				5%	100%
Eff./COP	75%	70%	75%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.43	1.33	0.59	0.33	0.22	1.00	

Peak Heating Load 62.6 W/m² 19.8 Btu/hr.ft²
Seasonal Heating Load (Tertiary Load) 562 MJ/m².yr 14.5 kWh/ft².yr
Sizing Factor 1.00
Electric Fuel Share 5.0% Fossil Fuel Share 95.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft².yr	14.5
MJ/m².yr	562

Fossil Fuel EUI	
kWh/ft².yr	19.6
MJ/m².yr	760

Market Composite EUI	
kWh/ft².yr	19.4
MJ/m².yr	750

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers Standard	 HE	Screw Chillers	Recip. Chiller	Pkgd. DX	Absorption Chillers W. H.	 CW	Total
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load 30 W/m² 10 Btu/hr.ft² 1251 ft²/Ton
Seasonal Cooling Load (Tertiary Load) 9.6 MJ/m².yr 0.2 kWh/ft².yr
Sizing Factor 1.00 Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 5.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft².yr	0.1
MJ/m².yr	3

Natural Gas EUI	
kWh/ft².yr	
MJ/m².yr	

Market Composite EUI	
kWh/ft².yr	0.1
MJ/m².yr	3

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Avg. Tank				Boiler
System Present (%)	85%				
Eff./COP	0.65				0.75

	Fossil		Elec. Res.
Fuel Share	85%		15%
Blended Efficiency	0.65		0.91

Service Hot Water load (MJ/m².yr) (Tertiary Load) 18.2
Wetting Use Percentage 90%

All Electric EUI	
kWh/ft².yr	0.5
MJ/m².yr	20

Fossil Fuel EUI	
kWh/ft².yr	0.7
MJ/m².yr	28

Market Composite EUI	
kWh/ft².yr	0.7
MJ/m².yr	26.8

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Wholesale			Yukon
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	1.1	L/s.m^2	0.22	CFM/ft^2
System Static Pressure CAV	300	Pa	1.2	wg
System Static Pressure VAV	300	Pa	1.2	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	0.7	W/m^2	0.07	W/ft^2
Fan Design Load VAV	0.7	W/m^2	0.07	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.01	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.03	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.60	W/m^2	0.06	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m^2	0.002	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m^2	0.0019	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	50	kPa	17	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.1	W/m^2	0.01	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	4.4	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.4	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.0	kWh/m^2.yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.6	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI		
	kWh/ft^2.yr	0.6
	MJ/m^2.yr	23.1

COMMERCIAL SECTOR BUILDING PROFILE

EXISTING BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Warehouse/Wholesale **Yukon**
Baseline

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 10.1 kWh/ft^2 yr 391.1 MJ/m^2 yr **Fossil Fu** 19.3 kWh/ft^2 yr 745.9 MJ/m^2 yr

END USE:	kWh/ft^2 yr	MJ/m^2 yr
GENERAL LIGHTING	0.6	22.3
ARCHITECTURAL LIGHTING	0.5	18.3
HIGH BAY LIGHTING	4.2	161.3
OTHER PLUG LOADS	0.4	16.1
HVAC FANS & PUMPS	0.6	23.1
REFRIGERATION	1.8	70.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	17.7
ELEVATORS		
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Fossil Fuel	
	kWh/ft^2 yr	MJ/m^2 yr	kWh/ft^2 yr	MJ/m^2 yr
SPACE HEATING	0.7	28.1	18.6	722.1
SPACE COOLING	0.0	0.2		
DOMESTIC HOT WATER	0.1	3.0	0.6	23.8
FOOD SERVICE EQUIPMENT	0.1	4.0		

Terms Used in Building Profile Summaries

Profile Term	Explanation
Building envelope	Defines the thermal characteristics of a building's exterior components
U-value	The rate of heat loss, in Btu per hour per square foot per degree Fahrenheit (BTU/hr. f^2.°F) through walls, roofs and windows. The U-value is the reciprocal of the R-value
Shading coefficient (SC)	Is a measure of the total amount of heat passing through the glazing compared with that through a single clear glass
Window-to-wall ratio	Defines the ratio of window to insulated exterior wall area
General lighting	Defines the lighting types that are used within the main areas of a building, e.g., for a School, the area is classrooms and the lighting type is fluorescent; for a Food Retail store, the main area is the retail floor.
LPD	Lighting power density expressed in terms of W/ft^2
Lux	The amount of visible light per square meter incident on a surface (lumen/m^2)
Inc	Incandescent lamps
CFL	Compact fluorescent lamps
T12	T12 fluorescent lamps with magnetic ballasts
T8	T8 fluorescent lamps with electronic ballasts
MH	Metal halide lamps
HPS	High-pressure sodium lamps
HID	High-intensity discharge lighting includes both MH and HPS
Secondary lighting	Defines the lighting types that are used within the secondary areas of a building, e.g., for a School, the secondary areas are corridors, lobbies, foyers, etc.,
Tertiary lighting	Defines the lighting types that are used within special purpose areas of a building, e.g., for a School, the tertiary area is a gymnasium.
Outdoor lighting	Defines the outdoor lighting including parking lot and façade
Overall LPD	The total floor weighted LPD that includes general, secondary, tertiary, and outdoor.
Fans	Defines mix of air handling systems
CAV	Constant air volume
VAV	Variable air volume
space heating	Defines the mix of heating equipment types found within the stock of buildings
ASHP	Air-source heat pump
WSHP	Water-source heat pump
Resistance	Electric resistance heating equipment including boilers and baseboard heaters
Natural gas	Natural gas heating equipment including packaged rooftop units and boilers
Space cooling	Defines the mix of cooling equipment types found within the stock of buildings
Centrifugal	Standard centrifugal chillers with a full load performance of 0.75 kW/ton
Centri HE	High-efficiency centrifugal chillers assumed to have a performance of <0.65 kW/ton
Recip open	Semi-hermetic reciprocating chillers
DX	Direct expansion cooling equipment that use small tonnage hermetic R-22 compressors

Appendix B Background-Section 4: Base Year Peak Load

Introduction

Appendix B provides additional detailed information related to each of the major steps employed in the generation of the Commercial sector Base Year peak loads. The discussion is organized as follows:

- Overview of peak load methodology
- Segmentation of commercial buildings
- Detailed results.

B1 Overview of Peak Load Profile Methodology

As noted in the main text, development of the electric peak load estimates employs four specific factors as outlined below:

- **Monthly Usage Allocation Factor:** This factor represents the percent of annual electric energy usage that is allocated to each month. This set of monthly fractions (percentages) reflects the seasonality of the load shape, whether a facility, process or end use, and is dictated by weather or other seasonal factors. In decreasing order of priority, this allocation factor can be obtained from either: (a) monthly consumption statistics from end-use load studies; (b) monthly seasonal sales (preferably weather normalized) obtained by subtracting a "base" month from winter and summer heating and cooling months; or (c) heating or cooling degree days on an appropriate base.

- **Weekend to Weekday Factor:** This factor is a ratio that describes the relationship between weekends and weekdays, reflecting the degree of weekend activity inherent in the facility or end use. This may vary by month or season. Based on this ratio, the average electric energy per day type can be computed from the corresponding monthly electric energy.

- **Peak Day Factor:** This factor reflects the degree of daily weather sensitivity associated with the load shape, particularly heating or cooling; it compares a peak (e.g., hottest or coldest) day to a typical weekday in that month.

- **Per Unit Hourly Factor:** The relationship of load among different hours of the day for each day type (weekday, weekend day, peak day) and for each month reflects the operating hours of the electric equipment or end use within commercial facilities by sub sector. For example, for lighting, this would be affected by time of day, season (affected by daylight), and room type, where applicable. For the Base Year, lighting is treated on an aggregate basis by total facility.

The four factors (sets of ratios) defined above provide the basis for converting annual energy to any hourly demand specified including the grouping of hours used in the three peak periods defined in this study. Exhibit B 1, below, illustrates how each of the above four factors is applied sequentially to a known annual energy value to produce a peak load value, defined as a specific peak period. In the example, Peak Period 1 (annual system peak hour) is used.

Exhibit B 1 Illustrative Application of Annual Energy to Peak Period Value Factors

Peak Period 1 (annual system peak hour) is computed based on the December peak day at 6 pm. The Yukon peak is assumed to occur in December, although the model allows for a January peak, as well.

The following steps are required:

- *Step 1:* The monthly usage allocation factor for December is applied to the annual energy use to calculate December energy use.
- *Step 2:* The average weekday in December is calculated based on the formula shown below, which adjusts the average day type use to reflect any difference in typical weekend use versus typical weekday use.
- 1/[Days in Month * (5/7 + 2/7 * Wkend Ratio)]
- *Step 3:* The peak day factor is then applied to the average weekday electric energy use to determine the peak day use (as defined by Yukon Energy).
- *Step 4:* The peak hour is then calculated based on allocating the peak day use according to the per unit hourly load factor for a peak winter (December) day, using the percentage of use in that hour versus the daily usage for the December peak day.

It should be noted that the methodology shown in Exhibit B 1 produces aggregate diversified average loads for all customers or end uses in the defined sub sector.

Exhibit B 2 provides a specific numeric example for the calculation of peak hour demand (kW) under the Peak Period 1 definition. The example presented in Exhibit B 2 is for space heating use in Offices. The example shows how the annual consumption of 10,000 kWh can be converted to a peak demand value for Peak Period 1 by the calculation of a corresponding hours-use value.

Exhibit B 2 Sample Hours-Use Calculation for Office Electric Space Heating

Peak Period 1: 6 pm Winter Peak (December) =

Annual kWh * Mo. Allocation (Dec.) * 1/(Days in Month * (5/7 + 2/7 * Wkend Ratio)) * Peak Day Factor * Pk Hour % Daily kWh

6 pm Winter Peak = 10,000 [Annual kWh] * 14.75% [Mo. Allocation] * 1/(31 * (5/7 + 2/7 * 1.0 [Dec. Wkend Ratio Calc])) * 1.39 [Dec. Peak Day Factor] * 0.04105 [Pk Hour % Day kWh] = 3.098 kW

Hours-use Factor =10,000 [annual kWh] / 2.3755 [6pm Winter Peak] = 4,210 [Peak Period 1 Hours Use, in Red on Ex B5, LL Code 2022]

This means that any applicable Office annual space heating kWh can be converted to demand at winter peak hour (6 pm) by dividing by 4,210.

For other peak periods, different sets of hours are used, with calculations corresponding to the above steps. The resulting relationship between annual use and peak can be defined in terms of an hours-use factor, the ratio of the annual energy to the peak, for each of the three defined peak periods.

B2 Segmentation of Commercial Buildings

The Commercial sector segmentation used to generate the electric peak load profiles is the same as that used for electric energy use. That is, there is a load profile that corresponds to each combination of sub sector and end use.

Exhibit B 3 shows the Commercial sub sectors and end uses that were addressed.

Exhibit B 3 Commercial Segmentation Used for Electric Peak Load Calculations

Sub sectors (Office, Food Retail, Non-Food Retail, Hotel/Motel, Health, Education, Restaurant, Warehouse/Wholesale, Recreation Centres)

End uses (general lighting, outdoor lighting, architectural lighting, street lighting, space heating, space cooling, food service equipment, domestic hot water, refrigeration, computers/plug load)

Exhibit B 4 describes the assumptions and data sources for each of the four load profile factors that were used to develop the corresponding hours-use factors. To produce a demand for combination of sub sector and end use, the corresponding annual energy is divided by the hours-use factor for each of the three peak periods for the applicable load shape. For certain end uses that are assumed to have no usage during the winter months (e.g., cooling) the hours-use values are considered infinite (noted by 1E+15), resulting in virtually zero demand when divided into annual energy.

Exhibit B 4 Commercial End Use Load Shape Parameters

Load Shape #	End Use	Monthly Breakdown	Wkend / Wkday Ratio	Peak Day Factor	Hourly Profile
2001	General lighting – Office	RG&E Office lighting	App. 0.50 RG&E Office lighting	1.0 Assumed	Office lighting - RG&E 1991 Study[1]
2002	General lighting – Non-food Retail	RG&E Retail lighting	RG&E Retail lighting	1.0 Assumed	RG&E Retail lighting
2003	General lighting – Food Retail	RG&E Grocery lighting	RG&E Grocery lighting	1.0 Assumed	RG&E Grocery lighting
2004	General lighting – Hotel/Motel	RG&E Hotel/Motel lighting	RG&E Hotel/Motel lighting	1.0 Assumed	RG&E Hotel/Motel lighting
2005	General lighting – Health	RG&E Hospital/Long-term Care lighting	RG&E Hospital/Long-term Care lighting	1.0 Assumed	RG&E Hospital/Long-term Care lighting
2006	General lighting – Education	RG&E College lighting	RG&E College lighting	1.0 Assumed	RG&E College lighting

---

[1] Rochester Gas & Electric Company; 1991 DSM Evaluation Report Load Shape working papers.

Load Shape #	End Use	Monthly Breakdown	Wkend / Wkday Ratio	Peak Day Factor	Hourly Profile
2007	General lighting – Restaurant	RG&E Full-serve Restaurant lighting	RG&E Full-serve Restaurant lighting	1.0 Assumed	RG&E Full-serve Restaurant lighting
2008	General lighting – Warehouse	RG&E Warehouse lighting	RG&E Warehouse lighting	1.0 Assumed	RG&E Warehouse lighting
2009	General lighting – Small Office and Other Commercial	RG&E Office lighting	RG&E Office lighting (modified)[2]	1.0 Assumed	RG&E Office lighting (modified)
2010	General lighting – Small Non-food Retail	RG&E Small Non-food Retail lighting	RG&E Non-food Retail lighting (modified)	1.0 Assumed	RG&E Non-food Retail lighting (modified)
2011	Architectural lighting – Office & Education	Architectural lighting model	1.0 Assumed	1.0 Assumed	Architectural lighting model 6 am-6 pm 100%, 50% evening, 10% overnight
2012	Architectural lighting – Retail & Restaurant	Architectural lighting model	1.0 Assumed	1.0 Assumed	Architectural lighting model 6 am-10 pm 100%, 50% evening, 10% overnight
2013	Architectural lighting – Health & Warehouse	Architectural lighting model	1.0 Assumed	1.0 Assumed	Architectural lighting model 6 am-10 pm 100%, 80% evening, 50% overnight
2014	Architectural lighting – all other	Architectural lighting model	1.0 Assumed	1.0 Assumed	Architectural lighting model 6 am-6 pm 100%, 50% evening, 10% overnight
2015	Refrigeration – Restaurant, Hotel, Health	RG&E Restaurant refrigeration	RG&E total Restaurant refrigeration	RG&E total Restaurant refrigeration	RG&E total Restaurant refrigeration
2016	Refrigeration – Food Retail	RG&E Grocery refrigeration	RG&E Grocery refrigeration	RG&E Grocery refrigeration	RG&E Grocery refrigeration
2017	Refrigeration – Warehouse / Wholesale	RG&E Warehouse refrigeration	RG&E Warehouse refrigeration	RG&E Warehouse refrigeration	RG&E Warehouse refrigeration
2018	Refrigeration – Education	RG&E School refrigeration	RG&E School refrigeration	RG&E School refrigeration	RG&E School refrigeration
2019	Refrigeration – all Other Commercial	RG&E total Commercial refrigeration	RG&E total Commercial refrigeration	RG&E total Commercial refrigeration	RG&E total Commercial refrigeration
2020	Streetlighting	Based on dusk-to-dawn lighting model	1.0 Assumed	1.0 Assumed	Dusk-to-dawn model, average Whitehorse sunrise/ sunset
2021	Outdoor lighting	Based on outdoor lighting model	1.0 Assumed	1.0 Assumed	Outdoor lighting model, with RG&E 1991 study factors (0.55 overnight, 0.1 day, 1.0 eve.)

---

[2] Modifications for per-unit load shapes for Small Office and Small Non-food Retail reduced overnight loads by 50% after 6 pm (Office) and after 9 pm (Non-food Retail).

Load Shape #	End Use	Monthly Breakdown	Wkend / Wkday Ratio	Peak Day Factor	Hourly Profile
2022	Space heating – Office	10-year average Whitehorse HDD[3]	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 Study for Office Space Heating
2023	Space heating – Retail Food/Non-Food	10-year average Whitehorse HDD	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 study for Retail Space heating
2024	Space heating – Hotel/ Health	10-year average Whitehorse HDD	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 study for Hospital/Long-term care space heating
2025	Space heating – School / University	10-year average Whitehorse HDD	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 study for School space heating
2026	Space heating – Restaurant	10- year average Whitehorse HDD	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 study for total Restaurant space heating
2027	Space heating – all Other Commercial	10-year average Whitehorse HDD	1.0 Assumed	10-year average ratio of peak/avg. HDD	RG&E 1991 study for Commercial space heating
2028	Food service equipment – Restaurant	RG&E total Restaurant cooking	RG&E total Restaurant cooking	RG&E total Restaurant cooking	RG&E total Restaurant cooking
2029	Food service equipment – Hotel / Health	RG&E total Hospital/Long-term Care cooking	RG&E total Hospital/Long-term Care Cooking	RG&E total Hospital/Long-term Care Cooking	RG&E total Hospital/Long-term Care cooking
2030	Food service equipment – Food Retail	RG&E Grocery cooking	RG&E Grocery cooking	RG&E Grocery cooking	RG&E Grocery cooking
2031	Food service equipment – School/University	RG&E School cooking	RG&E School cooking	RG&E School cooking	RG&E School cooking
2032	Food service equipment – all Other Commercial	RG&E School cooking	RG&E School cooking	RG&E School cooking	RG&E School cooking
2033	Domestic hot water (DHW) – Restaurant	RG&E Restaurant water heat	RG&E Restaurant water heat	RG&E Restaurant water heat	RG&E Restaurant water heat
2034	Domestic hot water (DHW) – Hotel / Health	RG&E total Commercial water heat	RG&E total Commercial water heat	RG&E total Commercial water heat	RG&E total Commercial water heat
2035	DHW – Food Retail and Non-Food Retail	RG&E Retail water heat	RG&E Retail water heat	RG&E Retail water heat	RG&E Retail water heat
2036	DHW – School / University	RG&E School water heat	RG&E School water heat	RG&E School water heat	RG&E School water heat
2037	DHW – all Other Commercial	RG&E water heat Commercial	RG&E water heat Commercial	RG&E water heat Commercial	RG&E water heat Commercial

---

[3] Heating degree days on an 18°C base for period 2001 - 2010 for the Whitehorse weather station.

Load Shape #	End Use	Monthly Breakdown	Wkend / Wkday Ratio	Peak Day Factor	Hourly Profile
2038	Space cooling – All Commercial	10-year average CDD	RG&E total Commercial (app. 0.74 – 0.82)	RG&E 1991 study for Commercial space cooling	RG&E 1991 study for Commercial space cooling
2039	Computer, plug load	RG&E Office lighting	RG&E Office lighting	1.0 Assumed	RG&E Office lighting
2040	Elevators	NYC subways	NYC subways (0.7881)	1.0 Assumed	NYC subways (6 am-6 pm), arch Office lighting (6 pm –6 am)
2041	Engine Block Heaters	10-yr average Whitehorse HDD	1.0 assumed	10-yr average Whitehorse HDD	Flat, average 7.9 hrs/day for 90 days[4]

Data Sources

As noted, class load profiles by rate class and end uses and, where applicable, valid sub sector segments of those rate classes and end uses, were the preferred source for load profile factors. For monthly breakdowns, sales data were available for many sub sectors and were used wherever possible, as indicated above. The principal sources used for other factors were:

- Rochester Gas & Electric 1991 load study – RG&E conducted a detailed end-use load and modeling study of residential and commercial end uses to support its DSM program portfolio and provided these results as backup in its regulatory filings for several years.
- Data from the Yukon can be used to substitute for the above sources as it becomes available. The LOADLIB model is designed to make the process of updating any load profile component straightforward. A sample (Office general lighting) of the tables and graphic outputs of the LOADLIB model, with 10,000 annual kWh used for illustrative purposes is provided at the end of this appendix.
- As indicated, class load profiles by rate class and, where applicable, valid subs segments of those rate classes (e.g., usage level strata), were to be used to calibrate class total hourly load profiles.

Exhibit B 5 shows the distinct hour-use values developed for each combination of peak period, sector, sub sector and end use employed in this study, as generated from the applicable load shape.

The hours-use value represents the divisor to convert annual energy (e.g., MWH) to that peak period demand. For example, dividing the annual electricity consumed for space heating in Offices (LL Code 2022), the hours-use value for Peak Period 1 (i.e., 4,210) will convert annual MWH to demand at the annual system peak hour (6 pm).

---

[4] Ontario Power Authority – OPA Measures and Assumptions List (prescriptive) as of January 31, 2010; 1,450 watts at 7.9 hours/day x 90 days.

Exhibit B 5 Commercial Sector Load Shape Hours-Use Values

LL. Code	Sector Type	SubSector	Region	End Use	End Use Sub	Hours Use Values			
						Measure	Peak1	Peak2	Peak3
2001	Com	Large Office	All	General Lighting	All	Base	5,582	6,187	6,489
2002	Com	Non-Food Retail	All	General Lighting	All	Base	4,898	5,192	10,774
2003	Com	Food Retail	All	General Lighting	All	Base	6,590	6,761	7,802
2004	Com	Hotel/Motel	All	General Lighting	All	Base	6,618	6,918	7,065
2005	Com	Hospital/Long Term Care	All	General Lighting	All	Base	7,877	7,561	6,751
2006	Com	School/University	All	General Lighting	All	Base	5,672	5,681	7,575
2007	Com	Restaurant	All	General Lighting	All	Base	6,985	6,918	11,851
2008	Com	Warehouse/Wholesale	All	General Lighting	All	Base	5,112	5,706	4,747
2009	Com	Small Office/Other Comm.	All	General Lighting	All	Base	4,831	6,671	5,595
2010	Com	Small Non-Food Retail	All	General Lighting	All	Base	4,360	4,598	9,542
2011	Com	Office and School	All	Architectural Lighting	All	Base	6,053	8,070	6,053
2012	Com	Retail and Restaurant	All	Architectural Lighting	All	Base	6,778	6,778	6,778
2013	Com	Health and Warehouse	All	Architectural Lighting	All	Base	7,874	7,874	7,874
2014	Com	All Other	All	Architectural Lighting	All	Base	6,053	8,070	6,053
2015	Com	Restaurant/ Hotel/ Health	All	Refrigeration	All	Base	7,783	7,775	8,188
2016	Com	Food Retail	All	Refrigeration	All	Base	8,806	8,739	9,158
2017	Com	Warehouse/Wholesale	All	Refrigeration	All	Base	7,339	6,999	7,511
2018	Com	School/University	All	Refrigeration	All	Base	6,341	10,658	11,242
2019	Com	All Other	All	Refrigeration	All	Base	8,003	7,924	8,492
2020	Com	Streetlighting	All	Streetlighting	All	Base	3,901	4,792	3,674
2021	Com	All	All	Outdoor Lighting	All	Base	2,976	3,571	5,032
2022	Com	Office	All	Space Heating	All	Base	4,210	4,754	2,645
2023	Com	Retail Food and Non-Food	All	Space Heating	All	Base	3,165	3,183	2,354
2024	Com	Hotel, Hospital/Long Term Care	All	Space Heating	All	Base	3,464	3,880	3,161
2025	Com	School/University	All	Space Heating	All	Base	4,533	5,302	2,245
2026	Com	Restaurant	All	Space Heating	All	Base	3,639	4,353	2,697
2027	Com	All Other	All	Space Heating	All	Base	3,660	4,019	2,728
2028	Com	Restaurant	All	Food Service Equip.	All	Base	4,771	5,004	7,186
2029	Com	Hotel, Hospital/Long Term Care	All	Food Service Equip.	All	Base	5,067	6,134	4,521
2030	Com	Retail Food	All	Food Service Equip.	All	Base	11,361	12,159	5,951
2031	Com	School/University	All	Food Service Equip.	All	Base	165,008	61,915	2,211
2032	Com	All Other	All	Food Service Equip.	All	Base	165,008	61,915	2,211
2033	Com	Restaurant	All	Domestic Hot Water	All	Base	5,139	5,483	8,196
2034	Com	Hotel, Hospital/Long Term Care	All	Domestic Hot Water	All	Base	5,571	5,984	7,909
2035	Com	Retail Food and Non-Food	All	Domestic Hot Water	All	Base	13,538	8,120	21,754
2036	Com	School/University	All	Domestic Hot Water	All	Base	1.E+15	24,610	6,349
2037	Com	All Other	All	Domestic Hot Water	All	Base	5,571	5,984	7,909
2038	Com	All	All	Space Cooling	All	Base	1.E+15	1.E+15	1.E+15
2039	Com	All	All	Computer, Plug Load	All	Base	5,582	6,187	6,489
2040	Com	All	All	Elevators	All	Base	4,769	6,217	4,552
2041	Com	All	All	Engine Block Heaters	All	Base	1,493	1,194	1.E+15

Since YEC and YECL do not conduct regular class or end-use load analysis studies, there are no actual total (or sub sector) end-use load profiles upon which to calibrate the load profile models developed for this study. End-use data collection has not been performed. Summing all end use consumption would produce a total commercial daily load profile, but the Yukon class load profile to which it would be compared would still only be a statistical estimate and not an actual, in the same way that the annual kWh energy sales would be for the calibration of total annual kWh. The best option for calibrating Yukon-specific load profile parameters is the weather-sensitive loads, since that is the most area-specific.

Since separately metered space heating end-use load data were not available, normal weather for the past 10 years was used to determine monthly allocations, and weekend/weekday ratios were developed from similar studies for another winter-peaking Canadian utility.

For peak day factors, the past 10 years of average versus peak weather conditions (in heating degree days) was analyzed for Whitehorse to determine typical peak day factors for normal weather. The resulting peak day factors ranged from about 1.2 to 1.5 for winter months. For non weather-sensitive end uses, a factor of 1.0 was assumed, absent specific load study data.

B4 Detailed Results

Exhibit B 6, Exhibit B 7 and Exhibit B 8 show hydro region peak demand by sub sector and end use for each of the three peak periods identified for this study.

Note:

- The results shown in the following exhibits are measured at the customer's point-of-use and do not include line losses. Any differences in totals are due to rounding.
- Zeros that appear in the following exhibits should be read as small but non-zero numbers. Actual values of zero are shown as a dash (-).

Exhibit B 6 Commercial Sector Base Year (2010) Hydro Region, Period 1 - Peak Hour Demand, by Sub Sector and End Use (MW)

Sub Sector	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Elevators	Miscellaneous	Street Lighting	Non Buildings	Block Heater	Grand Total
Office	1.1	0.3	-	0.2	1.3	0.0	0.5	0.1	0.7	0.2	0.0	0.0	0.0	0.1	-	-	-	4.6
Food Retail	0.1	0.1	0.2	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.7	-	0.0	-	-	-	1.4
Non-food Retail	0.9	0.4	0.2	0.3	0.6	0.0	0.3	0.0	0.1	0.1	0.0	0.0	-	0.0	-	-	-	3.0
Hotel / Motel	0.1	0.2	-	0.1	0.6	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	-	-	-	1.6
Healthcare	0.1	0.1	-	0.1	0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-	-	-	0.8
Education	0.6	0.2	0.1	0.1	0.7	0.0	0.3	0.0	0.2	0.2	0.0	0.1	-	0.0	-	-	-	2.5
Recreation Centres	0.1	0.0	0.4	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	-	0.0	-	-	-	1.2
Restaurant	0.1	0.2	-	0.2	0.3	0.0	0.1	0.1	0.0	0.0	0.2	0.2	-	0.0	-	-	-	1.4
Warehouse / Wholesale	0.2	0.1	1.2	0.2	0.3	0.0	0.2	0.0	0.1	0.1	0.0	0.4	-	0.1	-	-	-	2.8
Other General Service	1.5	0.6	0.2	0.4	1.3	0.0	0.5	0.1	0.5	0.3	0.0	0.1	0.0	0.1	-	-	-	5.6
Street lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-	-	0.9
Non-Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	-	2.2
Parking Lot Plug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2	0.2
Grand Total	4.8	2.3	2.1	1.8	5.5	0.0	2.2	0.4	1.8	1.1	0.3	1.8	0.1	0.6	0.9	2.2	0.2	28.2

Exhibit B 7 Commercial Sector Base Year (2010) Hydro Region, Period 2 - Annual System Peak, by Sub Sector and End Use (MW)

Sub Sector	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Elevators	Miscellaneous	Street Lighting	Non Buildings	Block Heater	Grand Total
Office	1.0	0.2	-	0.2	1.2	0.0	0.4	0.1	0.6	0.2	0.0	0.0	0.0	0.1	-	-	-	4.0
Food Retail	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.7	-	0.0	-	-	-	1.4
Non-food Retail	0.9	0.4	0.2	0.2	0.6	0.0	0.2	0.0	0.1	0.1	0.0	0.0	-	0.0	-	-	-	2.8
Hotel / Motel	0.1	0.2	-	0.1	0.5	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	-	-	-	1.4
Healthcare	0.2	0.1	-	0.1	0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-	-	-	0.7
Education	0.6	0.2	0.1	0.1	0.6	0.0	0.3	0.0	0.2	0.1	0.0	0.0	-	0.0	-	-	-	2.3
Recreation Centres	0.1	0.0	0.3	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.3	-	0.0	-	-	-	1.1
Restaurant	0.1	0.2	-	0.2	0.3	0.0	0.1	0.1	0.0	0.0	0.2	0.2	-	0.0	-	-	-	1.3
Warehouse / Wholesale	0.1	0.1	1.1	0.2	0.3	0.0	0.2	0.0	0.1	0.1	0.0	0.4	-	0.1	-	-	-	2.5
Other General Service	1.4	0.5	0.1	0.3	1.1	0.0	0.5	0.1	0.5	0.2	0.0	0.1	0.0	0.1	-	-	-	4.9
Street lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.7	-	-	0.7
Non-Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	-	2.2
Parking Lot Plug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	0.3
Grand Total	4.5	1.9	1.9	1.5	4.9	0.0	2.1	0.4	1.6	0.9	0.3	1.9	0.1	0.4	0.7	2.2	0.3	25.6

Exhibit B 8 Base Year (2010) Hydro Region, Period 3, Annual Morning System Peak, by Sub Sector and End Use (MW)

Sub Sector	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Food Service Equipment	Refrigeration	Elevators	Miscellaneous	Street Lighting	Non Buildings	Block Heater	Grand Total
Office	0.9	0.3	-	0.1	2.1	0.0	0.4	0.1	0.6	0.2	0.1	0.0	0.0	0.2	-	-	-	5.0
Food Retail	0.1	0.1	0.1	0.1	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.7	-	0.0	-	-	-	1.4
Non-food Retail	0.4	0.4	0.1	0.2	0.8	0.0	0.1	0.0	0.1	0.1	0.0	0.0	-	0.1	-	-	-	2.3
Hotel / Motel	0.1	0.2	-	0.1	0.6	0.0	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	-	-	-	1.5
Healthcare	0.2	0.1	-	0.0	0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-	-	-	0.8
Education	0.5	0.2	0.1	0.1	1.3	0.0	0.2	0.2	0.2	0.2	0.2	0.0	-	0.0	-	-	-	3.2
Recreation Centres	0.1	0.0	0.4	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.3	-	0.0	-	-	-	1.3
Restaurant	0.0	0.2	-	0.1	0.4	0.0	0.1	0.0	0.0	0.0	0.1	0.2	-	0.0	-	-	-	1.3
Warehouse / Wholesale	0.2	0.1	1.3	0.1	0.4	0.0	0.2	0.0	0.1	0.1	0.1	0.3	-	0.1	-	-	-	3.0
Other General Service	1.3	0.6	0.1	0.2	2.1	0.0	0.5	0.1	0.5	0.3	0.1	0.1	0.0	0.2	-	-	-	5.9
Street lighting	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.0	-	-	1.0
Non-Buildings	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.2	-	2.2
Parking Lot Plug	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Grand Total	3.8	2.3	2.1	1.1	8.3	0.0	1.9	0.4	1.5	1.2	0.8	1.8	0.1	0.6	1.0	2.2	0.0	28.9

B5 Sample LOADLIB Output

The following exhibits provide sample LOADLIB load shape library outputs, with Office space heating (LL Code 2022) as the example, assuming 10,000 annual kWh.

Exhibit B 9 Commercial Sector LOADLIB Output – Summary Page

OFFICE - HEATING-YE

ENERGY PROFILE SUMMARY: ***SPHOFFRGE-BCLMYE*** 2022

2022 ANNUAL USE:	**1000**	kWH	PEAK HR(s)	18	17
	1000		PK MONTH(s)	12	7

	MONTHLY USAGE	PEAK DAY USAGE	AVERAGE WEEKDAY USAGE	AVERAGE WEEKEND USAGE	NON-COIN PEAK DEMAND	COIN PEAK DEMAND	SEAS
JAN	156	7.2	5.0	5.0	0.4463	0.2180	W
FEB	126	6.4	4.5	4.5	0.3854	0.2130	W
MAR	118	5.9	3.8	3.8	0.3495	0.1868	W
APR	79	4.6	2.6	2.6	0.3023	0.1371	W
MAY	51	3.3	1.7	1.7	0.3577	0.0000	S
JUN	26	1.8	0.9	0.9	0.1898	0.0000	S
JUL	20	1.3	0.7	0.7	0.1411	0.0000	S
AUG	27	1.7	0.9	0.9	0.1664	0.0245	S
SEP	50	3.3	1.7	1.7	0.3222	0.0473	S
OCT	80	4.3	2.6	2.6	0.4149	0.0609	S
NOV	120	5.9	4.0	4.0	0.3630	0.1553	W
DEC	148	6.6	4.8	4.8	0.3723	0.2375	W

OFFICE - HEATING-YE

ANNUAL STATISTICS:

AVERAGE DEMAND	**0.1142**	kW DEMAND		
PEAK DEMAND	0.4463	kW	0.7439	kW
NON-COIN LOAD FACTOR	25.58%			
NON-COIN PEAK HOURS USE	2241		1344	hrs/yr
			3.68	hrs/day

COINCIDENT PEAK STATISTICS: Demand Factor 60.0%

WINTER COINCIDENT PEAK	**0.2375**	kW	
6 PM in DEC			
ANNUAL COINCIDENCE FACTOR	53.22%		
PEAK DAY COINCIDENCE FACTOR	49.32%		
COIN PEAK LOAD FACTOR	48.06%		
COIN PEAK HOURS USE	**4210**		
SUMMER COINCIDENT PEAK	**0.0000**	kW	✂
5 PM in JUL			✂
COIN PEAK HOURS USE	**#N/A**		

Annual Peak Hours	7a-10p Weekday / Non-Holidays		3731	hours	249	days
	Peak Energy		422	kWH		
	Percent Peak		42.2%			

		Peak 1	Peak 2	Peak 3	
OFFICE - HEATI	SPHOFFRGE-BCLMYE	4,210	4,754	2,645	HRS USE
		Winter Pk H18 hours use	Win Pk H17-20 hours use	Dec Pk Hr8-9 hours use	
	Average Demands	0.2375 kW	0.2104 kW	0.3780 kW	

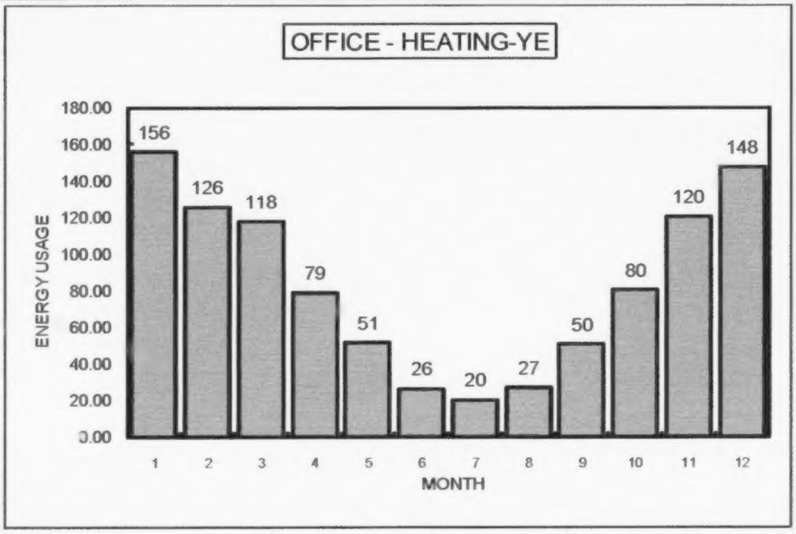
Exhibit B 10 Commercial Sector LOADLIB Output – Page 2

OFFICE - HEATING-YE

ENERGY PROFILE GRAPHIC SUMMARY **SPHOFFRGE-BCLMY** 2022

MONTHLY USAGE BREAKDOWN: kWH

JANUARY	156
FEBRUARY	126
MARCH	118
APRIL	79
MAY	51
JUNE	26
JULY	20
AUGUST	27
SEPTEMBER	50
OCTOBER	80
NOVEMBER	120
DECEMBER	148
	1,000



JULY AVG WKDAY	JANUARY AVG WKDAY	Hr
0.03	0.18	1
0.03	0.18	2
0.05	0.19	3
0.06	0.19	4
0.07	0.19	5
0.10	0.27	6
0.06	0.34	7
0.06	0.31	8
0.00	0.27	9
0.00	0.26	10
0.00	0.25	11
0.00	0.24	12
0.00	0.23	13
0.00	0.22	14
0.00	0.22	15
0.00	0.21	16
0.00	0.13	17
0.00	0.14	18
0.01	0.16	19
0.02	0.16	20
0.04	0.16	21
0.03	0.17	22
0.03	0.17	23
0.03	0.17	24

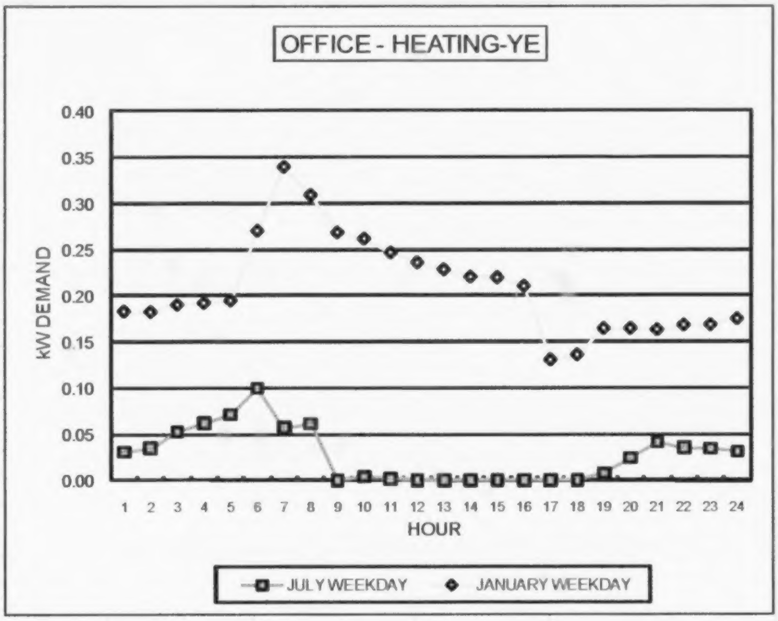


Exhibit B 11 Commercial Sector LOADLIB Output – Page 3

OFFICE - HEATING-YE

PEAK MONTH ENERGY PROFILE GRAPHIC SUMMARY **_SPHOFFRGE-BCLMY_** 2022

PEAK MONTH OF: DEC

HOUR	PEAK DAY	WEEKDAY	WEEKEND
1	0.18	0.17	0.16
2	0.21	0.17	0.16
3	0.22	0.17	0.17
4	0.23	0.17	0.16
5	0.25	0.18	0.17
6	0.31	0.23	0.21
7	0.36	0.27	0.25
8	0.34	0.26	0.27
9	0.33	0.26	0.25
10	0.36	0.26	0.24
11	0.37	0.25	0.23
12	0.35	0.23	0.23
13	0.33	0.22	0.23
14	0.31	0.21	0.22
15	0.31	0.21	0.22
16	0.30	0.20	0.22
17	0.23	0.13	0.17
18	0.24	0.14	0.17
19	0.27	0.18	0.18
20	0.27	0.17	0.19
21	0.23	0.17	0.17
22	0.22	0.17	0.16
23	0.19	0.16	0.17
24	0.20	0.17	0.17

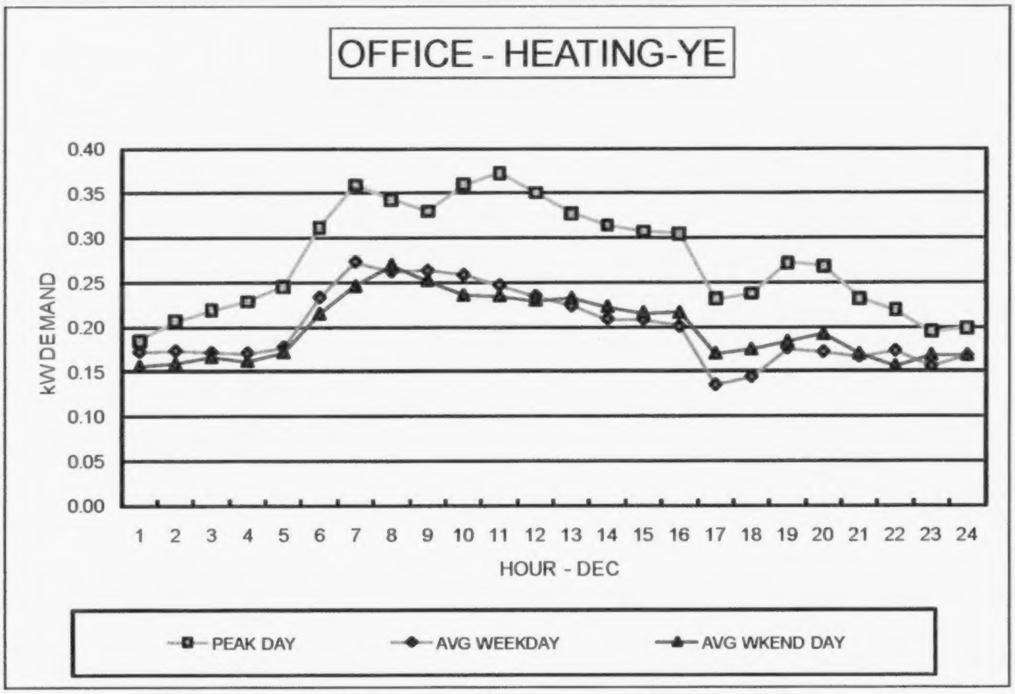


Exhibit B 12 Commercial Sector LOADLIB Output – Page 4

OFFICE - HEATING-YE SPHOFFRGE-BCLMYE 2022

BILLING PARAMETERS ANALYSIS

	kWH	kW	Monthly	Weekday	Hr End7a-10p Wkday Peak Period		
	Monthly kWh	Month Pk kW	Load Factor	Load Factor	Peak kWh	Off-Peak	Peak %
JAN	156	0.446	46.9%	61.6%	66	90	42.5%
FEB	126	0.385	48.5%	62.8%	53	73	42.2%
MAR	118	0.350	45.3%	51.3%	52	65	44.5%
APR	79	0.302	36.1%	40.8%	32	47	40.3%
MAY	51	0.358	19.2%	42.6%	22	29	42.5%
JUN	26	0.190	19.2%	27.1%	12	15	44.5%
JUL	20	0.141	19.2%	27.1%	9	12	42.5%
AUG	27	0.166	21.6%	21.6%	11	15	42.5%
SEP	50	0.322	21.6%	21.6%	21	29	42.4%
OCT	80	0.415	25.9%	42.2%	34	46	42.5%
NOV	120	0.363	46.0%	60.6%	51	69	42.4%
DEC	148	0.372	53.2%	72.7%	60	88	40.4%
Avg. Mo.	83	0.318	35.9%	44.3%	35	48	42.2%
Annual	1,000	0.446	25.6%		422	578	42.2%
Avg Hour	0.11				0.113	0.115	

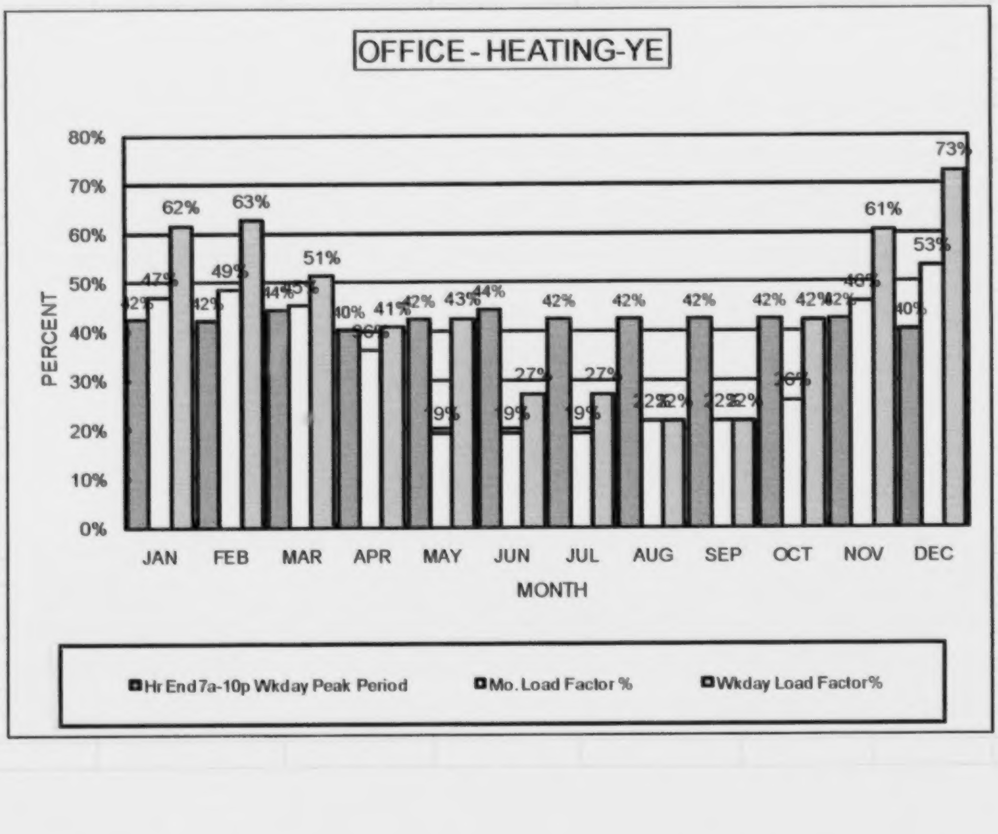
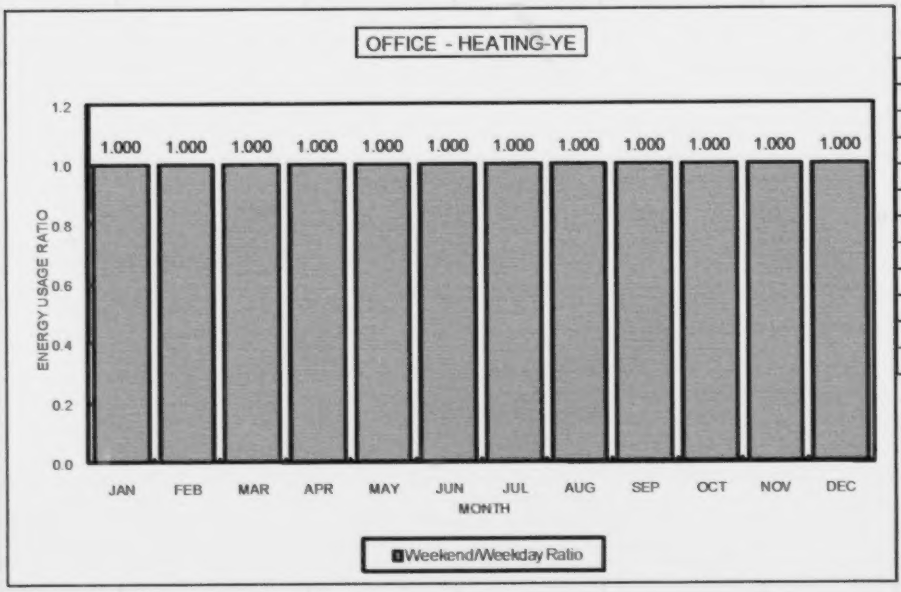


Exhibit B 13 Commercial Sector LOADLIB Output – Page 5

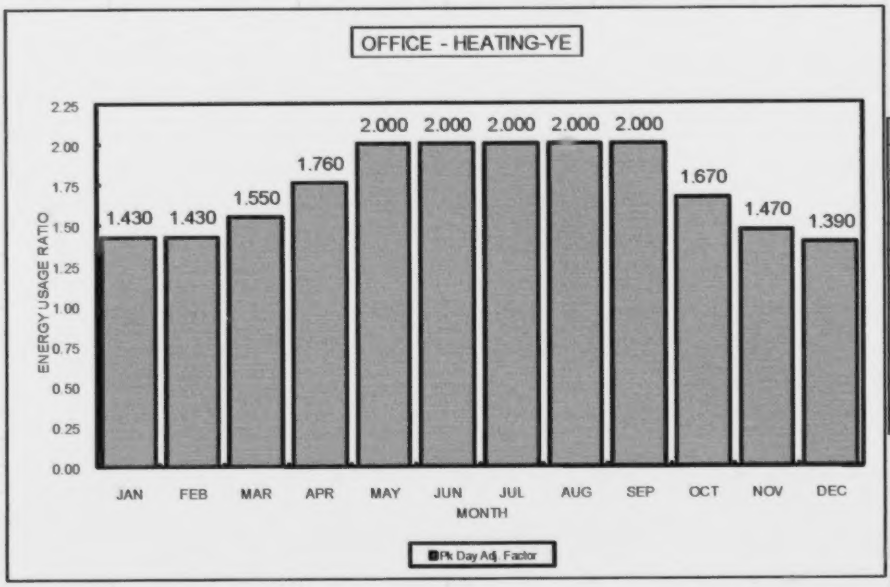
OFFICE - HEATING-YE **SPHOFFRGE-BCLMY** 2022

Weekend/Weekday Ratio



	Wkend/ Wkday
JAN	1.000
FEB	1.000
MAR	1.000
APR	1.000
MAY	1.000
JUN	1.000
JUL	1.000
AUG	1.000
SEP	1.000
OCT	1.000
NOV	1.000
DEC	1.000

Peak Day Adjustment Factor



	PDAF
JAN	1.430
FEB	1.430
MAR	1.550
APR	1.760
MAY	2.000
JUN	2.000
JUL	2.000
AUG	2.000
SEP	2.000
OCT	1.670
NOV	1.470
DEC	1.390

Appendix C Background-Section 5: Reference Case Electricity Use

Introduction

Appendix C provides additional detailed information related to the construction of the Commercial sector Reference Case. The appendix discusses the following:

- Natural change assumptions
- Expected growth in building stock
- CEEAM archetype summaries – new buildings.

C 1 Natural Change Assumptions

For the purposes of this study, "natural" changes to electricity consumption are defined as those changes to electricity usage patterns that occur without incentive or other intervention. Expected natural changes in electricity consumption patterns over the study period take into account four major factors:

- Naturally-occurring improvements in equipment efficiency
- Expected stock penetration by more efficient equipment
- Changes in equipment density, e.g., computers and plug loads, etc.
- Changes in electric share in end uses for which fuel may vary, such as space heating and water heating.

Note that the first two factors will have the effect of reducing electricity consumption, while the third and fourth factor may result in either increased or decreased electricity demand. While all of these factors influence future electricity use within the Commercial sector, the fourth, specifically increased space heating penetration in new buildings, is the dominant driver of new Commercial sector load growth in the Reference Case.

Based on the assessment of current trends, the most significant natural changes are expected to involve the following end uses:

- Space cooling
- Lighting
- Computer equipment and other plug loads
- Water heating
- Space heating.

Further discussion of these changes follows and, in each case, the discussion identifies the technical change, the major driver(s) and the assumed electricity impact.

Space Cooling

As a result of natural conservation and efficiency gains, it is assumed that new space cooling equipment will provide improved electricity performance compared to existing equipment. Packaged rooftop units are available on the market with energy-efficiency ratios (EER) exceeding 12.0.[5] Similarly, new centrifugal chillers achieve performance efficiencies in the range of 0.49-0.60 kW per ton. The combined effects of natural conservation and efficiency gains are estimated to result in a decrease of 6% in space cooling EUI over the length of the study.

---

[5] See http://www.energence.com/res/pdf/52W81_energence_58937_0709.pdf for example. Current federal energy-efficiency regulations require a minimum EER of 10.3 for rooftop air conditioning units with a capacity of 5.5 - 11 tons.

As illustrated in Exhibit C 1, the net effect of efficiency gains and increased space cooling saturation is expected to reduce energy consumption for space cooling in existing commercial buildings. Increases in overall space cooling energy use through time are expected to be due entirely to the construction of new building stock (Exhibit C 2).

Exhibit C 1 Reference Case Space Cooling Electricity Use in Existing Buildings by Sub Sector and Milestone Year – Hydro Region, Existing Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	569	560	552	543	535
Food Retail	38	37	36	36	35
Non-food Retail	152	150	148	146	143
Hotel / Motel	136	134	132	130	128
Healthcare	43	42	41	41	40
Education	48	47	47	46	45
Restaurant	62	61	60	59	58
Recreation Centres	3	3	3	3	3
Warehouse / Wholesale	6	6	6	6	6
Other General Service	507	499	492	484	477
Grand Total	1,564	1,540	1,517	1,493	1,470

Exhibit C 2 Reference Case Space Cooling Electricity Use in New Buildings by Sub Sector and Milestone Year – Hydro Region, New Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	-	171	361	571	805
Food Retail	-	11	22	35	50
Non-food Retail	-	52	110	174	246
Hotel / Motel	-	34	71	112	158
Healthcare	-	10	22	35	49
Education	-	11	24	37	53
Restaurant	-	18	37	60	85
Recreation Centres	-	0	1	1	1
Warehouse / Wholesale	-	1	3	4	6
Other General Service	-	-	-	-	-
Grand Total	-	308	650	1,030	1,452

Lighting

As a result of natural conservation, it is assumed that the replacement of existing T12 fluorescent lighting and electromagnetic ballasts with new T8 fluorescent lamps and electronic ballasts will continue. Similarly, CFLs will continue to increase their market share over incandescent lamps, particularly in sectors such as Hotel/Motel and Non-food Retail.

The continued growth of CFLs and T8 lighting/electronic ballasts is being driven by:

- Increased consumer recognition of the operating cost savings
- Energy regulations that are gradually removing electromagnetic fluorescent ballasts and incandescent lighting products from the market place.

Overall, the Reference Case assumes that by 2030 the energy intensity of general lighting in the existing building stock will decrease by 8%, while the energy intensity of architectural lighting will decrease by 1%.

Exhibit C 3 shows the impact of these EUI improvements on indoor lighting[6] energy consumption, while Exhibit C 4 shows indoor lighting energy use by sub sector and milestone year in new construction. Again, all increases in overall indoor lighting energy use through time are expected to be due entirely to the construction of new building stock

Exhibit C 3 Reference Case Lighting Electricity Use by Sub Sector and Milestone Year – Hydro Region, Existing Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	7,995	7,870	7,745	7,620	7,495
Food Retail	2,159	2,146	2,133	2,120	2,107
Non-food Retail	8,053	7,954	7,854	7,755	7,656
Hotel / Motel	2,248	2,228	2,208	2,189	2,169
Healthcare	1,595	1,571	1,546	1,522	1,497
Education	5,534	5,459	5,384	5,309	5,234
Restaurant	1,987	1,975	1,962	1,950	1,937
Recreation Centres	2,529	2,519	2,509	2,499	2,488
Warehouse / Wholesale	7,503	7,484	7,466	7,448	7,429
Other General Service	13,088	12,909	12,731	12,552	12,374
Grand Total	52,691	52,115	51,539	50,963	50,387

Exhibit C 4 Reference Case Lighting Electricity Use by Sub Sector and Milestone Year – Hydro Region, New Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	-	931	1,962	3,103	4,367
Food Retail	-	246	521	830	1,176
Non-food Retail	-	815	1,723	2,735	3,864
Hotel / Motel	-	229	483	767	1,083
Healthcare	-	161	339	534	750
Education	-	614	1,301	2,070	2,932
Restaurant	-	194	416	668	954
Recreation Centres	-	222	468	741	1,043
Warehouse / Wholesale	-	861	1,832	2,928	4,166
Other General Service	-	1,261	2,645	4,165	5,834
Grand Total	-	5,533	11,688	18,540	26,170

---

[6] Including general, architectural and high-bay lighting.

Computer Equipment and Other Plug Loads

Computer equipment and other plug loads will continue to grow as a result of increased density of computers and peripherals per occupant, increased use of server load, and growth in other peripherals, such as telephone network equipment. Increased penetration of laptops, more efficient server hardware and higher penetration of ENERGY STAR® rated computer equipment and other plug loads is expected to counterbalance the effect of increasing hardware density to some degree.

Overall, the Reference Case assumes that by 2030 the energy intensity of computer equipment and plug loads in the existing building stock will increase by 15%.[7] The impact on electricity use in existing buildings is shown in Exhibit C 5, below.

Exhibit C 5 Computer and Plug Load Energy Use in by Sub Sector and Milestone Year – Hydro Region, Existing Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	3,783	3,925	4,067	4,209	4,351
Food Retail	171	178	184	191	197
Non-food Retail	490	509	527	545	564
Hotel / Motel	338	351	363	376	389
Healthcare	232	241	250	258	267
Education	1,070	1,111	1,151	1,191	1,231
Restaurant	95	99	102	106	109
Recreation Centres	25	26	27	28	29
Warehouse / Wholesale	658	683	708	732	757
Other General Service	2,950	3,061	3,171	3,282	3,392
Grand Total	9,814	10,182	10,550	10,918	11,286

Water Heating

Electricity consumption for water heating is expected to stay constant within the existing building stock, but to grow rapidly within the new building stock, as electric water heating fuel shares are expected to be significantly higher in new buildings than in existing ones. This is largely driven by an expected increase in electric space heating in the new building stock (see below), and the fact that buildings rarely maintain oil or propane service for water heating alone.

Exhibit C 6 illustrates the increased difference in electric water heating penetration between existing and new buildings. This leads to a growth in electricity use for water heating, which outpaces growth in floor area by a significant margin, as illustrated in Exhibit C 7.

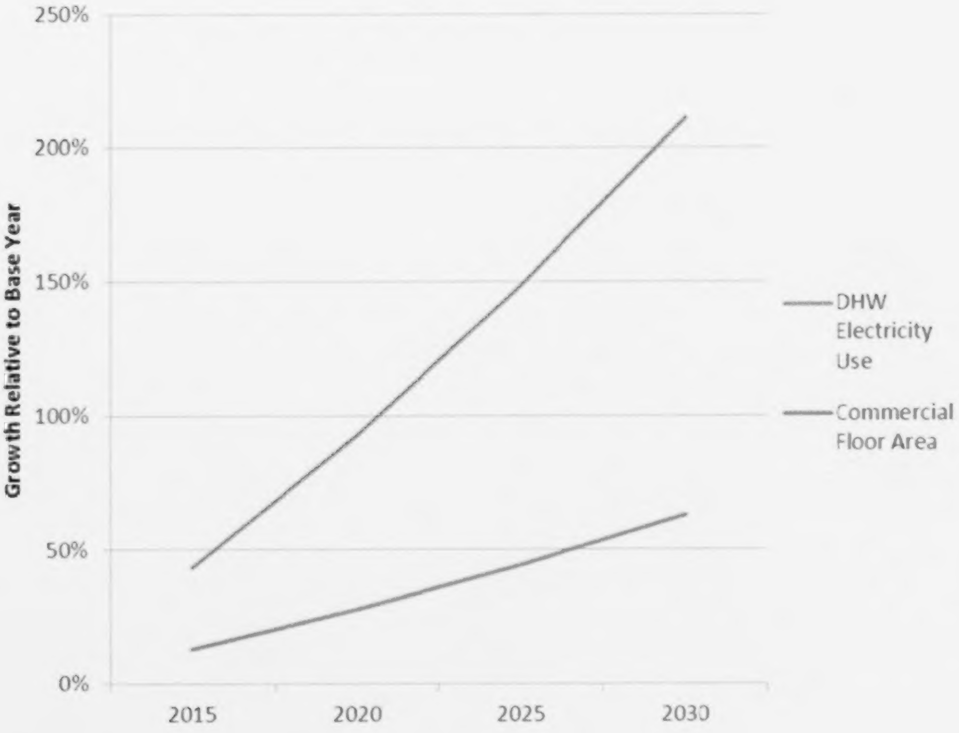
---

[7] Estimates based on scenarios presented in Arthur D. Little, *Electricity Consumption by Office and Telecommunication Equipment in Commercial Buildings*. U.S. Department of Energy, 2002.

Exhibit C 6 Electric DHW Share by Sub Sector – Hydro Region, Existing and New Buildings (%)

Sub Sector	Existing Buildings	New Buildings
Office	50%	90%
Food Retail	40%	80%
Non-food Retail	30%	85%
Hotel / Motel	15%	95%
Healthcare	10%	60%
Education	50%	75%
Restaurant	15%	80%
Recreation Centres	10%	55%
Warehouse / Wholesale	15%	70%

Exhibit C 7 Electric DHW Electricity Consumption Growth Relative to Commercial Floor Area Growth – Hydro Region, Existing and New Buildings (%)



Space Heating

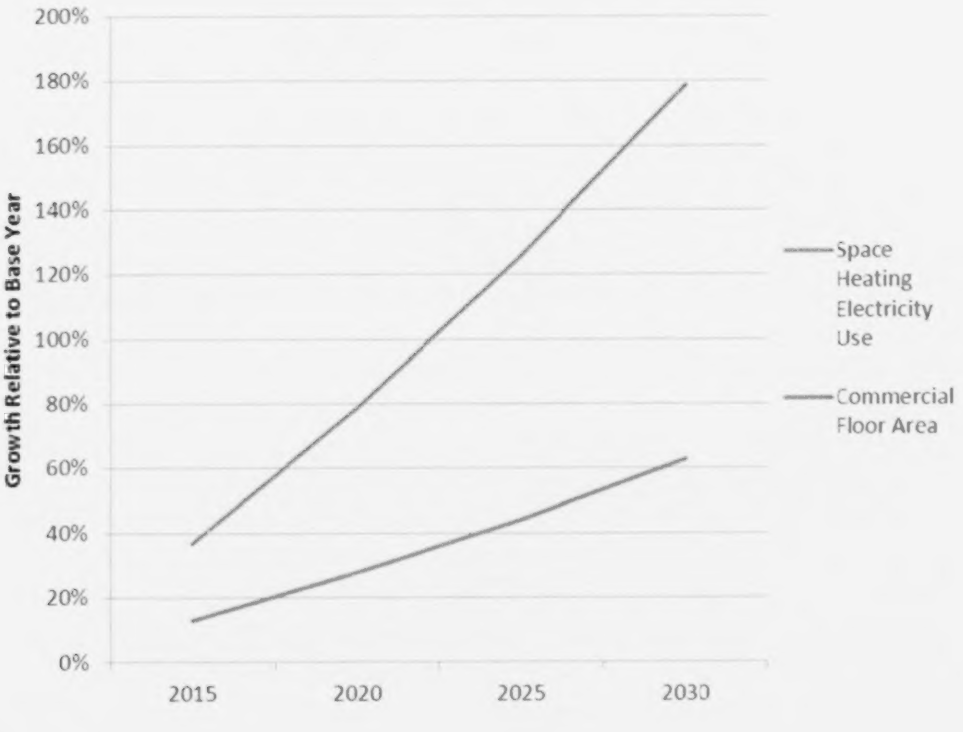
In recent years, electric space heating penetrations in new commercial construction have far exceeded the historical average, a trend that is presently expected to continue. Similar to the discussion of water heating energy above, electricity consumption for space heating is expected to stay constant within the existing building stock, but to grow rapidly within the new building stock. This is expected to be the major contributor to commercial load growth within the study period, accounting for approximately 35% of total commercial load growth.

Exhibit C 8 illustrates the increased difference in electric space heating penetration between existing and new buildings. This leads to a growth in electricity use for space heating, which outpaces growth in floor area by a significant margin, as illustrated in Exhibit C 9.

Exhibit C 8 Electric Space Heating Share by Sub Sector – Hydro Region, Existing and New Buildings (%)

Sub Sector	Existing Buildings	New Buildings
Office	50%	90%
Food Retail	40%	80%
Non-food Retail	30%	85%
Hotel / Motel	15%	95%
Healthcare	10%	60%
Education	50%	75%
Restaurant	15%	80%
Recreation Centres	10%	55%
Warehouse / Wholesale	15%	70%

Exhibit C 9 Electric Space Heating Electricity Consumption Growth Relative to Commercial Floor Area Growth – Hydro Region, Existing and New Buildings (%)



Overall Impact of Natural Changes

As illustrated in Exhibit C 10, the overall impact of the natural changes in energy usage patterns described above are very minimal, a decrease in existing building energy use of approximately 100 MWh, less than 0.1%, by 2030 relative to the Base Year (2010). This is consistent with the 2011 YEC 20-year load forecast, which assumes no per-customer electricity usage growth. Virtually all growth in electricity use through the study period occurs within the new building stock.

Exhibit C 10 Total Energy Use in by Sub Sector and Milestone Year – Hydro Region, Existing Buildings (MWh/yr.)

Sub Sector	2010	2015	2020	2025	2030
Office	23,792	23,837	23,882	23,927	23,972
Food Retail	10,137	10,136	10,135	10,134	10,132
Non-food Retail	14,252	14,191	14,130	14,069	14,007
Hotel / Motel	7,756	7,759	7,761	7,763	7,766
Healthcare	4,630	4,627	4,624	4,622	4,619
Education	14,514	14,511	14,508	14,505	14,502
Restaurant	7,549	7,544	7,539	7,534	7,528
Recreation Centres	6,739	6,738	6,736	6,735	6,733
Warehouse / Wholesale	14,529	14,558	14,586	14,615	14,644
Other General Service Buildings	29,290	29,260	29,230	29,200	29,170
Grand Total	133,189	133,160	133,131	133,102	133,073

C2 Expected Growth in Building Stock

The next step in developing the Reference Case involved the development and application of estimated levels of floor space growth in each building sub sector over the study period. The stock growth rates were derived from the sales forecast data provided by in the YEC 20-year Resource Plan - 2011. The derivation of floor space data in each of the milestone periods applied the following steps:

- As described above for the existing building stock, estimate and apply the expected impact of natural changes within the new building stock over the study period. Efficiency improvements are expected to be more moderate within the new building stock through time. Computer and other plug load growth are expected to be consistent in both existing and new buildings.
- Add floor space at a rate consistent with the YEC forecast of electricity consumption growth for each combination of sub sector and milestone year.

A summary of the total new commercial floor space at each milestone period is provided in Exhibit C 11.

Exhibit C 11 New Commercial Building Floor Space, by Sub Sector and Milestone Year – Hydro Region (ft^2)

Sub Sector	2015	2020	2025	2030
Office	177,356	377,774	604,251	860,177
Food Retail	25,449	54,212	86,719	123,458
Non-food Retail	121,260	258,639	414,279	590,606
Hotel / Motel	78,974	168,043	268,497	381,792
Healthcare	25,855	54,914	87,572	124,276
Education	245,057	524,585	843,434	1,207,135
Restaurant	29,049	62,434	100,804	144,902
Recreation Centres	56,705	119,848	190,160	268,456
Warehouse / Wholesale	189,815	404,667	647,859	923,127
Other General Service	210,674	446,254	709,685	1,004,261
Grand Total	1,160,195	2,471,370	3,953,260	5,628,190

C3 CEEAM Archetype Summaries – New Buildings

This section includes summary profiles of the nine new building archetypes constructed for this study. Exhibit C 12 presents a table of contents for the CEEAM building profiles that follow. A glossary of terms and acronyms used in the building profiles is included at the end of this appendix.

Exhibit C 12 Table of Contents - New CEEAM Building Profiles

Sub Sector	Page #
Office	C – 10
Food Retail	C – 15
Non-food Retail	C – 20
Hotel / Motel	C – 25
Healthcare	C – 30
Education	C – 35
Restaurant	C – 40
Recreation Centres	C – 45
Warehouse / Wholesale	C – 50
Terms Used in Building Profiles	C – 55

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Office Baseline			Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft².°F
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.35			
Shading Coefficient (SC)	0.58			

Typical Building Size	1,394	m²	15,000	ft²
Typical Footprint (m²)	697	m²	7,500	ft²
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	2			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	50%				50%				100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	26	m²/person	274	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	8	L/s.person	16	CFM/person

%OA 9.08%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation L/s.m² CFM/ft² operation (%)

Sizing Factor	1.1			
Total Air Circulation or Design Air Flow	3.24	L/s.m²	0.64	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²	CFM/ft²
Operation occupied period	50%		
Operation unoccupied period	50%		

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	279,953	
Peak Zone Sensible Load	186,991	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	8,699	
Total air circulation or Design air	3.24	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				98%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	23	°C	73.4	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Office **Yukon**
Baseline

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	12.9	W/m^2	1.2	W/ft^2

Occ. Period(Hrs./yr.)	3200
Unocc. Period(Hrs./yr.)	5560
Usage During Occupied Period	95%
Usage During Unoccupied Period	15%

Light Level (Lux)	300	500	700	1000		Total
% Distribution		100%				100%
Weighted Average						**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	4.2
	MJ/m^2.yr	162

ARCHITECTURAL LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	24.4	W/m^2	2.3	W/ft^2

Occ. Period(Hrs./yr.)	3200
Unocc. Period(Hrs./yr.)	5560
Usage During Occupied Period	95%
Usage During Unoccupied Period	30%

Light Level (Lux)	200	300	400	500		Total
% Distribution	10%	40%	40%	10%		100%
Weighted Average						**350**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	1.1
	MJ/m^2.yr	41

SPECIAL PURPOSE LIGHTING

Light Level		Lux		ft-candles
Floor Fraction (HBLFF)				
Connected Load		W/m^2		W/ft^2

Floor fraction check: should = 1.00 1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	0%
Usage During Unoccupied Period	100%

Light Level (Lux)	300	500	700	1000		Total
% Distribution						
Weighted Average						

	INC	CFL	T12	T8		MH	HPS	TOTAL
System Present (%)								
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	
	MJ/m^2.yr	

TOTAL LIGHTING Overall LP 14.06 W/m^2

EUI TOTAL	kWh/ft^2.yr	5.3
	MJ/m^2.yr	203

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		50			
Density (device/occupant)	0.9		0.9		0.15		0.1		0.26			
Connected Load	1.9	W/m^2	1.8	W/m^2	0.6	W/m^2	0.8	W/m^2	0.5	W/m^2	1.5	W/m^2
	0.2	W/ft^2	0.2	W/ft^2	0.05	W/ft^2	0.07	W/ft^2	0.05	W/ft^2	0.14	W/ft^2
Diversity Occupied Period	80%		80%		80%		80%		100%		80%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		2500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		6260	

Total end-use load (occupied period)	5.8	W/m^2	0.5	W/ft^2
Total end-use load (unocc. period)	3.8	W/m^2	0.4	W/ft^2

Usage during occupied period	100%
Usage during unoccupied period	66%

Computer Equipment	EUI	kWh/ft^2.yr	2.77
		MJ/m^2.yr	107.44
Plug Loads	EUI	kWh/ft^2.yr	0.72
		MJ/m^2.yr	27.70

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 5.0% Electricity Fuel Share: 95.0%

Kitchen

Natural Gas EUI		
EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0

All Electric EUI		
EUI	kWh/ft^2.yr	0.10
	MJ/m^2.yr	4.00

REFRIGERATION

Provide description below:

Lunch room/cafeteria/restaurant

EUI	kWh/ft^2.yr	0.10
	MJ/m^2.yr	4.00

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.52
	MJ/m^2.yr	20.00

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Office
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Natural Gas			Electric				Total
	Boilers		Packaged	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High	Unit					
System Present (%)	5%	5%	10%	10%	10%		60%	100%
Eff./COP	75%	85%	77%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.18	1.30	0.59	0.33	0.22	1.00	

Peak Heating Load 63.3 W/m^2 20.1 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 424 MJ/m^2.yr 11.0 kWh/ft^2.yr
Sizing Factor 1.00

Electric Fuel Share 80.0% Fossil Fuel Share 20.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	9.8
MJ/m^2.yr	380

Natural Gas EUI	
kWh/ft^2.yr	14.0
MJ/m^2.yr	542

Market Composite EUI	
kWh/ft^2.yr	10.6
MJ/m^2.yr	412

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		WSHP	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE		Open	DX	W. H.	CW	
System Present (%)		25.0%			75.0%			100.0%
COP	4.7	5.4	3.5	3.5	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.29	0.29	0.36	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load 59 W/m^2 19 Btu/hr.ft^2 643 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 108.0 MJ/m^2.yr 2.8 kWh/ft^2.yr

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 90.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	1.1
MJ/m^2.yr	42

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	1.1
MJ/m^2.yr	42

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	10%				
Eff./COP	0.55	0.70	0.90	0.75	0.90

	Fossil		Elec. Res.
Fuel Share	10%		90%
Blended Efficiency	0.55		0.94

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 22.8

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	24

Natural Gas EUI	
kWh/ft^2.yr	1.1
MJ/m^2.yr	41

Market Composite EUI	
kWh/ft^2.yr	0.7
MJ/m^2.yr	25.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Office
Baseline
Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.2	L/s.m^2	0.64	CFM/ft^2
System Static Pressure CAV	650	Pa	2.6	wg
System Static Pressure VAV	650	Pa	2.6	wg
Fan Efficiency	52%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	4.8	W/m^2	0.44	W/ft^2
Fan Design Load VAV	4.8	W/m^2	0.44	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	50%	50%	100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.3	L/s.m^2	0.06	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.4	L/s.m^2	0.08	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	40%			
Fan Motor Efficiency	80%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.018	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.05	W/m^2	0.10	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m^2	0.005	U.S. gpm/ft^2
Pump Head Pressure	100	kPa	33.333333	ft
Pump Efficiency	55%			
Pump Motor Efficiency	90%			
Sizing Factor	1.0			
Pump Connected Load	0.63	W/m^2	0.06	W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0037	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	150	kPa	50	ft		
Pump Efficiency	55%					
Pump Motor Efficiency	90%					
Sizing Factor	0.5					
Pump Connected Load	0.4	W/m^2	0.04	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	19.0	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.9	kWh/m^2.yr
Condenser Pump Energy Consumption	0.8	kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.5	kWh/m^2.yr
Circulating Pump Yearly Operation	5000	hrs./year
Circulating Pump Energy Consumption	0.8	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	2.1
	MJ/m^2.yr	82.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Office
Baseline
Yukon

EUI SUMMARY

TOTAL ALL END-USES: Electricity: 21.5 kWh/ft².yr 832.7 MJ/m².yr Gas: 2.9 kWh/ft².yr 112.7 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	4.2	162.1
ARCHITECTURAL LIGHTING	1.1	41.3
SPECIAL PURPOSE LIGHTING		
OTHER PLUG LOADS	0.7	27.7
HVAC FANS & PUMPS	2.1	82.5
REFRIGERATION	0.1	4.0
MISCELLANEOUS	0.5	20.0
COMPUTER EQUIPMENT	2.8	107.4
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	7.8	304.0	2.8	108.3
SPACE COOLING	1.0	37.4		
DOMESTIC HOT WATER	0.6	21.8	0.1	4.1
FOOD SERVICE EQUIPMENT	0.1	3.8	0.0	0.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail Baseline		New	Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft².°F
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.11			
Shading Coefficient (SC)	0.69			

Typical Building Size	2,788	m²	30,000	ft²
Typical Footprint (m²)	1,225	m²	13,181	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	6.0	m	19.7	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	45	m²/person	484	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	30	L/s.person	64	CFM/person

%OA 25.12%

Fresh Air Control Type *(enter a 1, 2 or 3) 1

(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:				
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	3			
Total Air Circulation or Design Air Flow	2.65	L/s.m²	0.52	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	278,751	
Peak Zone Sensible Load	112,333	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	5,226	
Total air circulation or Design air	2.65	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Food Retail
Baseline

SIZE:

VINTAGE:
New

REGION:
Yukon

LIGHTING

GENERAL LIGHTING

Light Level: 500 Lux | 46.5 ft-candles
Floor Fraction (GLFF): 0.45
Connected Load: 11.8 W/m^2 | 1.1 W/ft^2

Occ. Period(Hrs./yr.): 5000
Unocc. Period(Hrs./yr.): 3760
Usage During Occupied Period: 100%
Usage During Unoccupied Period: 20%

Light Level (Lux)	400	500	600	1000	Total
% Distribution		100%			100%
Weighted Average					500

	INC	CFL	T12	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)					100%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Fixture Cleaning:
Incidence of Practice:
Interval: years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft^2.yr	2.8
	MJ/m^2.yr	110

SECONDARY LIGHTING

Light Level: 500 Lux | 46.5 ft-candles
Floor Fraction (ALFF): 0.10
Connected Load: 47.6 W/m^2 | 4.4 W/ft^2

Occ. Period(Hrs./yr.): 5000
Unocc. Period(Hrs./yr.): 3760
Usage During Occupied lPeriod: 100%
Usage During Unoccupied Period: 20%

Light Level (Lux)	300	500	700	1000	Total
% Distribution		100%			100%
Weighted Average					500

	INC	CFL	T12	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	50%	50%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Fixture Cleaning:
Incidence of Practice:
Interval: years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	2.5
	MJ/m^2.yr	99

TERTIARY LIGHTING

Light Level: 500.00 Lux | 46.5 ft-candles
Floor Fraction (HBLFF): 0.45
Connected Load: 20.6 W/m^2 | 1.9 W/ft^2

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.): 4000
Unocc. Period(Hrs./yr.): 4760
Usage During Occupied Period: 100%
Usage During Unoccupied Period: 20%

Light Level (Lux)	300	500	700	1000	Total
% Distribution					
Weighted Average					500

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	85	

Fixture Cleaning:
Incidence of Practice:
Interval: years

Relamping Strategy & Incidence of Practice: Group | Spot

EUI	kWh/ft^2.yr	4.3
	MJ/m^2.yr	165

TOTAL LIGHTING

Overall LP 10.09 W/m^2

EUI TOTAL	kWh/ft^2.yr	10
	MJ/m^2.yr	374

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.65	0.65	0.01	0.01	0.03	
Connected Load	0.8 W/m^2	0.7 W/m^2	0.0 W/m^2	0.0 W/m^2	0.1 W/m^2	1.5 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.00 W/ft^2	0.00 W/ft^2	0.01 W/ft^2	0.14 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	90%
Diversity Unoccupied Period	50%	50%	50%	50%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2600	4100
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6160	4660

Total end-use load (occupied period): 2.9 W/m^2 | 0.3 W/ft^2
Total end-use load (unocc. period): 1.7 W/m^2 | 0.2 W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period: 100%
Usage during unoccupied period: 58%

Computer Equipment	EUI	kWh/ft^2.yr	0.88
		MJ/m^2.yr	33.97
Plug Loads	EUI	kWh/ft^2.yr	0.84
		MJ/m^2.yr	32.51

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share: 60.0%
Electricity Fuel Share: 40.0%

Natural Gas EUI		
EUI	kWh/ft^2.yr	2.6
	MJ/m^2.yr	100.0

All Electric EUI		
EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	60.0

REFRIGERATION

Provide description below:
Commercial refrigeration display cases

EUI	kWh/ft^2.yr	29.0
	MJ/m^2.yr	1125.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Food Retail
Baseline

SIZE:

VINTAGE:
New

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Natural Gas			Electric				
	Boilers Stan.	Boilers High	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	3%	2%	15%		5%		75%	100%
Eff./COP	80%	85%	78%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.25	1.18	1.28	0.31	0.33	0.22	1.00	

Peak Heating Load 20.9 W/m^2 6.6 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 405 MJ/m^2.yr 10.5 kWh/ft^2.yr
Sizing Factor 1.00

Electric Fuel Share 80.0% Fossil Fuel Share 20.0% Other Fuel Share

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	10.1
MJ/m^2.yr	392

Natural Gas EUI	
kWh/ft^2.yr	13.3
MJ/m^2.yr	513

Market Composite EUI	
kWh/ft^2.yr	10.7
MJ/m^2.yr	416

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.7	5.2	4.4	3.2	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.31	0.37	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	13.0	55.4

Peak Cooling Load 29 W/m^2 9 Btu/hr.ft^2 1291 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 49.6 MJ/m^2.yr 1.3 kWh/ft^2.yr

Sizing Factor 1.00 Operation (occ. period 4000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 75.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	21

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	21

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	15%			5%	
Eff./COP	60%	70%	90%	75%	90%

	Fossil		Elec. Res.
Fuel Share	20%		80%
Blended Efficiency	0.64		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 45.5

Wetting Use Percentage 20%

All Electric EUI	
kWh/ft^2.yr	1.3
MJ/m^2.yr	50

Natural Gas EUI	
kWh/ft^2.yr	1.8
MJ/m^2.yr	71

Market Composite EUI	
kWh/ft^2.yr	1.4
MJ/m^2.yr	54.3

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Food Retail Baseline		New	Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.7	L/s.m^2	0.52	CFM/ft^2
System Static Pressure CAV	600	Pa	2.4	wg
System Static Pressure VAV	600	Pa	2.4	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.3	W/m^2	0.31	W/ft^2
Fan Design Load VAV	3.3	W/m^2	0.31	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	100%		100%	
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.2	L/s.m^2	0.03	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.3	L/s.m^2	0.05	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.4	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.59	W/m^2	0.05	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m^2	0.002	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m^2	0.0019	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa	50	ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	5000	hrs./year
Supply Fan Unocc. Period	3760	hrs./year
Supply Fan Energy Consumption	29.1	kWh/m^2.yr
Exhaust Fan Occ. Period	5000	hrs./year
Exhaust Fan Unocc. Period	3760	hrs./year
Exhaust Fan Energy Consumption	3.1	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	3.0
	MJ/m^2.yr	116.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Food Retail
Baseline

SIZE:

VINTAGE:
New

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 54.9 kWh/ft^2·yr 2,127.9 MJ/m^2·yr Gas: 4.6 kWh/ft^2·yr 177.0 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	2.8	110.3
SECONDARY LIGHTING	2.5	98.6
TERTIARY LIGHTING	4.3	165.0
OTHER PLUG LOADS	0.8	32.5
HVAC FANS & PUMPS	3.0	116.7
REFRIGERATION	29.0	1,125.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.9	34.0
ELEVATORS		
OUTDOOR LIGHTING	1.1	42.4

END USE:	Electricity		Gas	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	8.1	313.3	2.7	102.7
SPACE COOLING	0.4	16.1		
DOMESTIC HOT WATER	1.0	40.0	0.4	14.3
FOOD SERVICE EQUIPMENT	0.6	24.0	1.5	60.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: Non-Food Retail Baseline

SIZE:

VINTAGE:

REGION: Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft².°F
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.10			
Shading Coefficient (SC)	0.78			

Typical Building Size	1,859	m²	20,000	ft²
Typical Footprint (m²)	1,859	m²	20,000	ft²
Footprint Aspect Ratio (L:W)	5			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	1			
Floor to Floor Height (m)	6.0	m	19.7	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	25	m²/person	269	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	15	L/s.person	32	CFM/person

%OA 18.39%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	34%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1.4			
Total Air Circulation or Design Air Flow	3.26	L/s.m²	0.64	CFM/ft²
Infiltration Rate	0.42	L/s.m²	0.08	CFM/ft²

(air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	433,075	
Peak Zone Sensible Load	197,282	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	9,178	
Total air circulation or Design air	3.26	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	21	°C	69.8	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Non-Food Retail
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

LIGHTING

GENERAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	11.8	W/m^2	1.1	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			

Light Level (Lux)	400	500	600	1000	Total
% Distribution	25%	50%	25%		100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)					100%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI		
EUI	kWh/ft^2.yr	4.3
	MJ/m^2.yr	165

ARCHITECTURAL LIGHTING

Light Level	500	Lux	46.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	34.8	W/m^2	3.2	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			

Light Level (Lux)	300	500	700	1000	Total
% Distribution	30%	40%	30%		100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	1.6
	MJ/m^2.yr	61

SPECIAL PURPOSE LIGHTING

Light Level	500.00	Lux	46.5	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	20.1	W/m^2	1.9	W/ft^2
Occ. Period(Hrs./yr.)	4400			
Unocc. Period(Hrs./yr.)	4360			
Usage During Occupied Period	95%			
Usage During Unoccupied Period	15%			

Floor fraction check: should = 1.00	1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	30%	40%	30%		100%
Weighted Average					**500**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	0.9
	MJ/m^2.yr	35

TOTAL LIGHTING

Overall LP 12.95 W/m^2

EUI TOTAL	kWh/ft^2.yr	6.7
	MJ/m^2.yr	260

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.18		0.18		0.01		0.01		0.02			
Connected Load	0.4	W/m^2	0.4	W/m^2	0.0	W/m^2	0.1	W/m^2	0.1	W/m^2	1.15	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2	0.01	W/ft^2	0.01	W/ft^2	0.11	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		4660	

Total end-use load (occupied period)	2.0	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	1.2	W/m^2	0.1	W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	59%

Computer Equipment	EUI	kWh/ft^2.yr	0.54
		MJ/m^2.yr	20.81
Plug Loads	EUI	kWh/ft^2.yr	0.64
		MJ/m^2.yr	24.92

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: Electricity Fuel Share: 100.0%

Small restaurants, food courts, kitchenettes

Natural Gas EUI		
EUI	kWh/ft^2.yr	0.4
	MJ/m^2.yr	15.0

All Electric EUI		
EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10.0

REFRIGERATION

Provide description below:

EUI	kWh/ft^2.yr	0.4
	MJ/m^2.yr	15.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Non-Food Retail Baseline			Yukon

SPACE HEATING

Heating Plant Type

	Natural Gas			Electric				Total
	Boilers		Packaged	A/A HP	W. S. HP	H/R Chiller	Resistance	
	Stan.	High	Rooftop					
System Present (%)	3%	2%	15%		10%		70%	100%
Eff./COP	75%	85%	77%	3.20	3.50	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.18	1.30	0.31	0.29	0.22	1.00	

Peak Heating Load	33.6	W/m^2	10.7	$Btu/hr.ft^2$
Seasonal Heating Load (Tertiary Load)	358	$MJ/m^2.yr$	9.3	$kWh/ft^2.yr$
Sizing Factor	1.00			

Electric Fuel Share 80.0% Fossil Fuel Share 20.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
$kWh/ft^2.yr$	8.5
$MJ/m^2.yr$	330

Natural Gas EUI	
$kWh/ft^2.yr$	12.0
$MJ/m^2.yr$	463

Market Composite EUI	
$kWh/ft^2.yr$	9.2
$MJ/m^2.yr$	357

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Recprocting Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.8	5.4	4.4	3.7	2.8	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.27	0.36	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	68	W/m^2	22	$Btu/hr\ ft^2$	554	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	64.1	$MJ/m^2.yr$	1.7	$kWh/ft^2.yr$		

Sizing Factor 1.00

A/C Saturation (Incidence of A/C) 80.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

All Electric EUI	
$kWh/ft^2.yr$	0.5
$MJ/m^2.yr$	21

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

Natural Gas EUI	
$kWh/ft^2.yr$	
$MJ/m^2.yr$	

Market Composite EUI	
$kWh/ft^2.yr$	0.5
$MJ/m^2.yr$	21

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	10.00%	5.00%			
Eff./COP	0.550	0.700	0.900	0.800	0.900

	Fossil		Elec. Res.
Fuel Share	15%		85%
Blended Efficiency	0.60		0.91

Service Hot Water load ($MJ/m^2.yr$) (Tertiary Load) 17.3

Wetting Use Percentage 90%

All Electric EUI	
$kWh/ft^2.yr$	0.5
$MJ/m^2.yr$	19

Natural Gas EUI	
$kWh/ft^2.yr$	0.7
$MJ/m^2.yr$	29

Market Composite EUI	
$kWh/ft^2.yr$	0.5
$MJ/m^2.yr$	20.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Non-Food Retail			**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	3.3	L/s.m^2	0.64	CFM/ft^2
System Static Pressure CAV	400	Pa	1.6	wg
System Static Pressure VAV	400	Pa	1.6	wg
Fan Efficiency	60%			
Fan Motor Efficiency	88%			
Sizing Factor	1.00			
Fan Design Load CAV	2.5	W/m^2	0.23	W/ft^2
Fan Design Load VAV	2.5	W/m^2	0.23	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	50	L/s.washroom	106	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.01	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.03	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.37	W/m^2	0.13	W/ft^2

Condenser Pump

Pump Design Flow		L/s.KW		U.S. gpm/Ton
Pump Design Flow per unit floor area		L/s.m^2		U.S. gpm/ft^2
Pump Head Pressure	45	kPa	15	ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0043	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	5500	hrs./year
Supply Fan Unocc. Period	3260	hrs./year
Supply Fan Energy Consumption	19.6	kWh/m^2.yr
Exhaust Fan Occ. Period	5500	hrs./year
Exhaust Fan Unocc. Period	3260	hrs./year
Exhaust Fan Energy Consumption	1.5	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	2.0
	MJ/m^2.yr	76.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Non-Food Retail
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES:	**Electricity:**	19.8	kWh/ft^2.yr	765.6	MJ/m^2.yr	**Gas:**	2.5	kWh/ft^2.yr	96.9	MJ/m^2.yr

END USE:	kWh/ft^2.yr	MJ/m^2.yr
GENERAL LIGHTING	4.3	164.8
ARCHITECTURAL LIGHTING	1.6	60.6
SPECIAL PURPOSE LIGHTING	0.9	34.9
OTHER PLUG LOADS	0.6	24.9
HVAC FANS & PUMPS	2.0	76.9
REFRIGERATION	0.4	15.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	20.8
ELEVATORS/ESCALATORS		
OUTDOOR LIGHTING	1.3	50.9

END USE:	Electricity		Gas	
	kWh/ft^2.yr	MJ/m^2.yr	kWh/ft^2.yr	MJ/m^2.yr
SPACE HEATING	6.8	264.0	2.4	92.6
SPACE COOLING	0.4	16.6		
DOMESTIC HOT WATER	0.4	16.2	0.1	4.3
FOOD SERVICE EQUIPMENT	0.3	10.0		

Fuel Specific EUIs for Heating Cooling & DHW

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hotel/Motel Baseline			Yukon

CONSTRUCTION

Wall U value (W/m^2.°C)	0.20	W/m^2.°C	0.04	Btu/hr.ft^2.°F
Roof U value (W/m^2.°C)	0.11	W/m^2.°C	0.02	Btu/hr.ft^2.°F
Glazing U value (W/m^2.°C)	1.60	W/m^2.°C	0.28	Btu/hr.ft^2.°F
Window/Wall Ratio (WIWAR) (%)	0.30			
Shading Coefficient (SC)	0.65			

Typical Building Size	1,859	m^2	20,000	ft^2
Typical Footprint (m^2)	1,859	m^2	20,000	ft^2
Footprint Aspect Ratio (L:W)	4			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	45%			
Typical # Stories	1			
Floor to Floor Height (m)	3.7	m	12.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	FCoils	IU	100% O.A	TOTAL
System Present (%)	90%				10%				100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m^2/person	538	ft^2/person
Occupancy Schedule Occ. Period	50%			
Occupancy Schedule Unocc. Period	80%			
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person

%OA 9.77%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m^2	0.10	CFM/ft^2
	50%	operation (%)		

Sizing Factor	1.2			
Total Air Circulation or Design Air Flow	2.05	L/s.m^2	0.40	CFM/ft^2
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m^2	0.14	CFM/ft^2

Separate Make-up air unit (100% OA)		L/s.m^2		CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	222,133	
Peak Zone Sensible Load	144,483	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	6,721	
Total air circulation or Design air	2.05	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Hotel/Motel
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.25			
Connected Load	11.6	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	4400	
Unocc. Period(Hrs./yr.)	4360	
Usage During Occupied Period	85%	
Usage During Unoccupied Period	15%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

					Total
Light Level (Lux)	200	300	400	500	Total
% Distribution			50%	50%	100%
Weighted Average					450

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	1.2
	MJ/m².yr	46

SECONDARY LIGHTING

Light Level	125	Lux	11.6	ft-candles
Floor Fraction (ALFF)	0.75			
Connected Load	8.7	W/m²	0.8	W/ft²

Occ. Period(Hrs./yr.)	2500	
Unocc. Period(Hrs./yr.)	6260	
Usage During Occupied Period	50%	
Usage During Unoccupied Period	25%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

					Total
Light Level (Lux)	100	125	150	300	Total
% Distribution	25%	50%	25%		100%
Weighted Average					125

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	75%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.7
	MJ/m².yr	66

TERTIARY LIGHTING

Light Level		Lux		ft-candles
Floor Fraction (HBLFF)				
Connected Load		W/m²		W/ft²

Floor fraction check: should = 1.00 | 1.00

Occ. Period(Hrs./yr.)	4000	
Unocc. Period(Hrs./yr.)	4760	
Usage During Occupied Period	0%	
Usage During Unoccupied Period	100%	
Fixture Cleaning:		
Incidence of Practice		
Interval		years

					Total
Light Level (Lux)					Total
% Distribution					
Weighted Average					

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)		0%				100%	0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	
	MJ/m².yr	

TOTAL LIGHTING

Overall LP 9.43 W/m²

EUI TOTAL	kWh/ft².yr	2.9
	MJ/m².yr	112

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.3		0.3		0.05		0.033		0.02			
Connected Load	0.3	W/m²	0.3	W/m²	0.1	W/m²	0.1	W/m²	0.1	W/m²	1.5	W/m²
	0.0	W/ft²	0.0	W/ft²	0.01	W/ft²	0.01	W/ft²	0.01	W/ft²	0.14	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		70%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2500		3000	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6260		5760	

Total end-use load (occupied period)	1.9	W/m²	0.2	W/ft²
Total end-use load (unocc. period)	0.9	W/m²	0.1	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	48%

Computer Equipment	EUI	kWh/ft².yr	0.51
		MJ/m².yr	19.79
Plug Loads	EUI	kWh/ft².yr	0.49
		MJ/m².yr	19.12

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 75.0% Electricity Fuel Share: 25.0%

Kitchen services

	Natural Gas EUI			All Electric EUI	
EUI	kWh/ft².yr	2.6	EUI	kWh/ft².yr	1.3
	MJ/m².yr	100.0		MJ/m².yr	50.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.8
	MJ/m².yr	30.0

MISCELLANEOUS

EUI	kWh/ft².yr	0.5
	MJ/m².yr	20

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Hotel/Motel
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Natural Gas			Electric				
	Boilers Stan.	Boilers High	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)		3%	2%				95%	100%
Eff./COP	75%	85%	75%	3.20	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.18	1.33	0.31	0.33	0.22	1.00	

Peak Heating Load: 50.1 W/m^2 — 15.9 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load): 338 MJ/m^2.yr — 8.7 kWh/ft^2.yr
Sizing Factor: 1.00
Electric Fuel Share: 95.0% — Fossil Fuel Share: 5.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	8.7
MJ/m^2.yr	338

Natural Gas EUI	
kWh/ft^2.yr	10.8
MJ/m^2.yr	419

Market Composite EUI	
kWh/ft^2.yr	8.8
MJ/m^2.yr	342

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE		Open	DX	W. H.	CW	
System Present (%)		20.0%			80.0%			100.0%
COP	4.7	5.4	4.4	3.5	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.29	0.34	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

	°C	°F
Chilled Water	7	44.6
Condenser Water	30	86
Supply Air	13.0	55.4

Peak Cooling Load: 35 W/m^2 — 11 Btu/hr.ft^2 — 1080 ft^2/Ton
Seasonal Cooling Load (Tertiary Load): 52.3 MJ/m^2.yr — 1.3 kWh/ft^2.yr
Sizing Factor: 1.00 — Operation (occ. perio 4000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C): 75.0%
Electric Fuel Share: 100.0% — Gas Fuel Share:

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	22

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	22

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)		5%			
Eff./COP	55%	70%	90%	75%	90%

	Fossil		Elec. Res.
Fuel Share	5%		95%
Blended Efficiency	0.70		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load): 236.6
Wetting Use Percentage: 90%

All Electric EUI	
kWh/ft^2.yr	6.7
MJ/m^2.yr	260

Natural Gas EUI	
kWh/ft^2.yr	8.7
MJ/m^2.yr	338

Market Composite EUI	
kWh/ft^2.yr	6.8
MJ/m^2.yr	263.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **Hotel/Motel** **Baseline**	**SIZE:**	**VINTAGE:**	**REGION:** **Yukon**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.0	L/s.m^2	0.40	CFM/ft^2
System Static Pressure CAV	300	Pa	1.2	wg
System Static Pressure VAV	300	Pa	1.2	wg
Fan Efficiency	45%			
Fan Motor Efficiency	70%			
Sizing Factor	1.00			
Fan Design Load CAV	2.0	W/m^2	0.18	W/ft^2
Fan Design Load VAV	2.0	W/m^2	0.18	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	60%	40%	100%	
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.04	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.022	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.76	W/m^2	0.07	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.002	L/s.m^2	0.003	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m^2	0.0022	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	90%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load	0.3	W/m^2	0.03	W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	13.0	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	2.4	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	0.1	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	1.5
	MJ/m^2.yr	57.1

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Hotel/Motel Baseline			Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 22.6 kWh/ft^2.yr 876.0 MJ/m^2.yr **Gas:** 2.9 kWh/ft^2.yr 112.8 MJ/m^2.yr

END USE:	kWh/ft^2.yr	MJ/m^2.yr
GENERAL LIGHTING	1.2	46.0
SECONDARY LIGHTING	1.7	66.1
TERTIARY LIGHTING		
OTHER PLUG LOADS	0.5	19.1
HVAC FANS & PUMPS	1.5	57.1
REFRIGERATION	0.8	30.0
MISCELLANEOUS	0.5	20.0
COMPUTER EQUIPMENT	0.5	19.8
ELEVATORS	0.1	3.9
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Gas	
	kWh/ft^2.yr	MJ/m^2.yr	kWh/ft^2.yr	MJ/m^2.yr
SPACE HEATING	8.3	321.0	0.5	20.9
SPACE COOLING	0.4	16.5		
DOMESTIC HOT WATER	6.4	247.0	0.4	16.9
FOOD SERVICE EQUIPMENT	0.3	12.5	1.9	75.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Health Care			**Yukon**
Baseline			

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft² .°F	Typical Building Size	8,829	m²	95,000	ft²
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft² .°F	Typical Footprint (m²)	1,400	m²	15,064	ft²
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft² .°F	Footprint Aspect Ratio (L:W)	2			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	45%			
Window/Wall Ratio (WIWAR) (%)	0.20								
Shading Coefficient (SC)	0.65				Typical # Stories	3			
					Floor to Floor Height (m)	4.3	m	14.0	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	FCoils	IU	100% O.A	TOTAL
System Present (%)	50%				50%				100%
Min. Air Flow (%)					60%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	30	m²/person	323	ft²/person	%OA	26.86%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period	75%					
Fresh Air Requirements or Outside Air	55	L/s.person	117	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3)	1	If Fresh Air Control Type = "2" enter % FA. to the right:	15%			
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)		If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
			50%	operation (%)		

Sizing Factor	6			
Total Air Circulation or Design Air Flow	6.82	L/s.m²	1.34	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.70	L/s.m²	0.14	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	#######	
Peak Zone Sensible Load	457,402	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R.H	13.2	ft³/lbm
Design CFM	21,278	
Total air circulation or Design air flx	6.82	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	24	°C	75.2	°F	16.5	°C	61.7	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	24	°C	75.2	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Health Care
Baseline
Yukon

LIGHTING

GENERAL LIGHTING

Light Level	450	Lux	41.8	ft-candles
Floor Fraction (GLFF)	0.90			
Connected Load	11.6	W/m²	1.1	W/ft²

Occ. Period(Hrs./yr.)	4500
Unocc. Period(Hrs./yr.)	4260
Usage During Occupied Period	90%
Usage During Unoccupied Period	30%

Light Level (Lux)	200	300	400	500	Total
% Distribution			50%	50%	100%
Weighted Average					450

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	5.2
	MJ/m².yr	201

SECONDARY LIGHTING

Light Level	350	Lux	32.5	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	15.4	W/m²	1.4	W/ft²

Occ. Period(Hrs./yr.)	8760
Unocc. Period(Hrs./yr.)	
Usage During Occupied Period	85%
Usage During Unoccupied Period	

Light Level (Lux)	200	300	400	500	Total
% Distribution		50%	50%		100%
Weighted Average					350

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)		100%					0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft².yr	1.1
	MJ/m².yr	41

TERTIARY LIGHTING

Light Level	250.00	Lux	23.2	ft-candles
Floor Fraction (HBLFF)				
Connected Load	8.2	W/m²	0.8	W/ft²

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	4000
Unocc. Period(Hrs./yr.)	4760
Usage During Occupied Period	100%
Usage During Unoccupied Period	100%

Light Level (Lux)	200	300	500	700	Total
% Distribution	50%	50%			100%
Weighted Average					250

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	5%	5%			90%		0%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft².yr	
	MJ/m².yr	

TOTAL LIGHTING

Overall LPD 12.00 W/m²

EUI TOTAL	kWh/ft².yr	6.2
	MJ/m².yr	242

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	54.55		51		100		200		217			
Density (device/occupant)	0.48		0.48		0.02		0.02		0.04			
Connected Load	0.9	W/m²	0.8	W/m²	0.1	W/m²	0.1	W/m²	0.3	W/m²	3.85	W/m²
	0.1	W/ft²	0.1	W/ft²	0.01	W/ft²	0.01	W/ft²	0.02	W/ft²	0.36	W/ft²
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2600		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6160		4660	

Total end-use load (occupied period)	5.4	W/m²	0.5	W/ft²
Total end-use load (unocc. period)	2.2	W/m²	0.2	W/ft²

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	40%

Computer Equipment	EUI	kWh/ft².yr	1.11
		MJ/m².yr	43.10
Plug Loads	EUI	kWh/ft².yr	1.74
		MJ/m².yr	67.29

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 75.0% Electricity Fuel Share: 25.0%

Commercial food services

Natural Gas EUI		
EUI	kWh/ft².yr	3.1
	MJ/m².yr	120.0

All Electric EUI		
EUI	kWh/ft².yr	2.1
	MJ/m².yr	80.0

REFRIGERATION

Provide description below:

Walk-in coolers/freezers, reach-in coolers/freezers, refrigerated buffet cases

EUI	kWh/ft².yr	0.4
	MJ/m².yr	15.0

MISCELLANEOUS

EUI	kWh/ft².yr	0.3
	MJ/m².yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Health Care
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Natural Gas			Electric				
	Boilers		Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
	Stan.	High						
System Present (%)	5%	20%	15%		5%		55%	100%
Eff./COP	75%	85%	78%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.18	1.28	0.59	0.33	0.22	1.00	

Peak Heating Load	33.7	W/m^2	10.7	Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load)	920	MJ/m^2.yr	23.7	kWh/ft^2.yr
Sizing Factor	1.00			
Electric Fuel Share	60.0%	Fossil Fuel Share	40.0%	

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	22.9
MJ/m^2.yr	887

Natural Gas EUI	
kWh/ft^2.yr	29.3
MJ/m^2.yr	1136

Market Composite EUI	
kWh/ft^2.yr	25.5
MJ/m^2.yr	987

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE		Open	DX	W. H.	CW	
System Present (%)		75.0%			25.0%			100.0%
COP	4.7	6.1	4.4	3.6	2.7	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.16	0.23	0.28	0.37	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	14.0	°C	57.2	°F

Peak Cooling Load	66	W/m^2	21	Btu/hr.ft^2	570	ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	56.2	MJ/m^2.yr	1.5	kWh/ft^2.yr		

Sizing Factor 1.00 Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 75.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	21

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	21

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)		5.00%		25.00%	10.00%
Eff./COP	60%	75%	90%	85%	90%

	Fossil		Elec. Res.
Fuel Share	40%		60%
Blended Efficiency	0.85		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 118.3

Wetting Use Percentage 90%

All Electric EUI	
kWh/ft^2.yr	3.4
MJ/m^2.yr	130

Natural Gas EUI	
kWh/ft^2.yr	3.6
MJ/m^2.yr	139

Market Composite EUI	
kWh/ft^2.yr	3.5
MJ/m^2.yr	133.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Health Care Baseline			Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	6.8	L/s.m^2	1.34	CFM/ft^2
System Static Pressure CAV	750	Pa	3.0	wg
System Static Pressure VAV	750	Pa	3.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	89%			
Sizing Factor	1.00			
Fan Design Load CAV	10.5	W/m^2	0.97	W/ft^2
Fan Design Load VAV	10.5	W/m^2	0.97	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	80%	20%	100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	75%	25%	75%	25%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.03	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.5	L/s.m^2	0.10	CFM/ft^2
Total Building Exhaust	0.6	L/s.m^2	0.13	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.9	W/m^2	0.08	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.017	kW/kW	0.06	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	1.09	W/m^2	0.10	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.004	L/s.m^2	0.005	U.S. gpm/ft^2
Pump Head Pressure	100	kPa	33	ft
Pump Efficiency	60%			
Pump Motor Efficiency	88%			
Sizing Factor	1.0			
Pump Connected Load	0.67	W/m^2	0.06	W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.003	L/s.m^2	0.0042	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	100	kPa	33	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	88%					
Sizing Factor	0.8					
Pump Connected Load	0.4	W/m^2	0.04	W/ft^2		

Supply Fan Occ. Period	4000	hrs./year
Supply Fan Unocc. Period	4760	hrs./year
Supply Fan Energy Consumption	68.0	kWh/m^2.yr
Exhaust Fan Occ. Period	4000	hrs./year
Exhaust Fan Unocc. Period	4760	hrs./year
Exhaust Fan Energy Consumption	6.5	kWh/m^2.yr
Condenser Pump Energy Consumption	0.7	kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.3	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	1.4	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	7.1
	MJ/m^2.yr	276.6

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Health Care
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 34.6 kWh/ft^2·yr 1,339.4 MJ/m^2·yr **Gas:** 15.5 kWh/ft^2·yr 600.3 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	5.2	200.7
SECONDARY LIGHTING	1.1	41.2
TERTIARY LIGHTING		
OTHER PLUG LOADS	1.7	67.3
HVAC FANS & PUMPS	7.1	276.6
REFRIGERATION	0.4	15.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	1.1	43.1
ELEVATORS	0.2	7.7
OUTDOOR LIGHTING	0.8	32.2

END USE:	Electricity		Gas	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	13.7	532.0	11.7	454.6
SPACE COOLING	0.4	15.6		
DOMESTIC HOT WATER	2.0	78.0	1.4	55.7
FOOD SERVICE EQUIPMENT	0.5	20.0	2.3	90.0

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Education
Baseline

Yukon

CONSTRUCTION

Wall U value (W/m^2.°C)	0.20	W/m^2.°C	0.04	Btu/hr.ft^2.°F
Roof U value (W/m^2.°C)	0.11	W/m^2.°C	0.02	Btu/hr.ft^2.°F
Glazing U value (W/m^2.°C)	1.60	W/m^2.°C	0.28	Btu/hr.ft^2.°F
Window/Wall Ratio (WIWAR) (%)	0.28			
Shading Coefficient (SC)	0.68			

Typical Building Size	4,000	m^2	43,040	ft^2
Typical Footprint (m^2)	2,000	m^2	21,520	ft^2
Footprint Aspect Ratio (L:W)	2			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	50%			
Typical # Stories	2			
Floor to Floor Height (m)	3.5	m	11.5	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)									

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	14	m^2/person	151	ft^2/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	6	L/s person	13	CFM/person

%OA 20.36%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right: 10%
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation 0.5 L/s.m^2 0.10 CFM/ft^2
50% operation (%)

Sizing Factor	1.1			
Total Air Circulation or Design Air Flow	2.10	L/s.m^2	0.41	CFM/ft^2
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.30	L/s.m^2	0.06	CFM/ft^2

Separate Make-up air unit (100% OA) L/s.m^2 CFM/ft^2
Operation occupied period 50%
Operation unoccupied period 50%

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	20%		80%		100%
Switchover Point		KJ/kg	20	°C	
		Btu/lbm	68	°F	

Summary of Design Parameters		
Peak Design Cooling Load	750,400	
Peak Zone Sensible Load	348,610	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	16,217	
Total air circulation or Design air	2.10	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic	35%	90%
DDC/Pneumatic	55%	
All DDC	10%	10%
Total (should add-up to 100%)	100%	100%

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	14	°C	57.2	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	17	°C	62.6	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year 4

Incidence of Annual Room Controls Maintenance 100.0%

Incidence of Annual HVAC Controls Maintenance 100%

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	100%
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	100%
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Education			Yukon
Baseline			

LIGHTING

GENERAL (CLASSROOM) LIGHTING

Light Level	420	Lux	39.0	ft-candles
Floor Fraction (GLFF)	0.80			
Connected Load	9.9	W/m^2	0.9	W/ft^2
Occ. Period(Hrs./yr.)	2000			
Unocc. Period(Hrs./yr.)	6760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	40%	60%			100%
Weighted Average					**470**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)					100%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	1.8
	MJ/m^2.yr	71

ARCHITECTURAL LIGHTING

Light Level	370	Lux	34.4	ft-candles
Floor Fraction (ALFF)	0.10			
Connected Load	16.3	W/m^2	1.5	W/ft^2
Occ. Period(Hrs./yr.)	2000			
Unocc. Period(Hrs./yr.)	6760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	65%	35%			100%
Weighted Average					370

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)		100%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.4
	MJ/m^2.yr	14

HIGH BAY (GYMNASIUM) LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.10			
Connected Load	13.0	W/m^2	1.2	W/ft^2
Occ. Period(Hrs./yr.)	2000			
Unocc. Period(Hrs./yr.)	6760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	10%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						75%	25%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	12

TOTAL LIGHTING

Overall LP 9.58 W/m^2

EUI TOTAL	kWh/ft^2.yr	3
	MJ/m^2.yr	97

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers	Monitors	Printers	Copiers	Servers	Plug Loads
Measured Power (W/device)	55	51	100	200	217	
Density (device/occupant)	0.16	0.16	0.02	0.02	0.01	
Connected Load	0.6 W/m^2	0.6 W/m^2	0.1 W/m^2	0.3 W/m^2	0.1 W/m^2	1 W/m^2
	0.1 W/ft^2	0.1 W/ft^2	0.01 W/ft^2	0.03 W/ft^2	0.01 W/ft^2	0.09 W/ft^2
Diversity Occupied Period	90%	90%	90%	90%	100%	100%
Diversity Unoccupied Period	25%	25%	25%	25%	100%	50%
Operation Occ. Period (hrs./year)	2000	2000	2000	2000	2000	2000
Operation Unocc. Period (hrs./year)	6760	6760	6760	6760	6760	6760

Total end-use load (occupied period)	2.6	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	1.0	W/m^2	0.1	W/ft^2

Usage during occupied period	100%
Usage during unoccupied period	40%

Computer Equipment	EUI	kWh/ft^2.yr	0.61
		MJ/m^2.yr	23.80
Plug Loads	EUI	kWh/ft^2.yr	0.50
		MJ/m^2.yr	19.37

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 50.0% Electricity Fuel Share: 50.0%

Cooking

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft^2.yr	0.8	EUI	kWh/ft^2.yr	0.5
	MJ/m^2.yr	30.0		MJ/m^2.yr	20.0

REFRIGERATION

Provide description below:

Coolers, freezers, pop machines

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**
Education
Baseline
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric					
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total	
System Present (%)		35%			25%		40%	100%	100%
Eff./COP	75%	85%	75%	1.70	3.00	4.50	1.00		
Performance (1 / Eff.) (kW/kW)	1.33	1.18	1.33	0.59	0.33	0.22	1.00		

Peak Heating Load 38.7 W/m^2 12.3 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 386 MJ/m^2.yr 10.0 kWh/ft^2.yr
Sizing Factor 1.00

Electric Fuel Share 65.0% Gas Fuel Share 35.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	10.0
MJ/m^2.yr	386

Natural Gas EUI	
kWh/ft^2.yr	8.5
MJ/m^2.yr	329

Market Composite EUI	
kWh/ft^2.yr	9.1
MJ/m^2.yr	352

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Reciprocting Chillers		Gas Cooling		Total
	Standard	HE		Open	DX	Absorption	Engine	
System Present (%)	10.0%			15.0%	75.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.6	0.9	1.8	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.38	1.11	0.56	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water	100%	
Condenser Water	100%	

Setpoint

	°C	°F
Chilled Water	6	42.8
Condenser Water	35	95
Supply Air	14.0	57.2

Peak Cooling Load 55 W/m^2 17 Btu/hr.ft^2 688 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 77.5 MJ/m^2.yr 2.0 kWh/ft^2.yr

Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

A/C Saturation (Incidence of A/C) 5.0%

Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit	100%	2
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.9
MJ/m^2.yr	35

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.9
MJ/m^2.yr	35

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Standard Boiler	Tank Heater	Tank Heater	Cnd. Boiler	Water Heater
System Present (%)	5%		20%		
Eff./COP	75%		70%	90%	90%

	Fossil		Elec. Res.	
Fuel Share	25%		75%	100%
Blended Efficiency	0.71		0.91	

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 40.0

Wetting Use Percentage 80%

All Electric EUI	
kWh/ft^2.yr	1.1
MJ/m^2.yr	44

All Natural Gas EUI	
kWh/ft^2.yr	1.5
MJ/m^2.yr	56

Market Composite EUI	
kWh/ft^2.yr	1.2
MJ/m^2.yr	47.1

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Education Baseline			Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.1	L/s.m^2	0.41	CFM/ft^2
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	500	Pa	2.0	wg
Fan Efficiency	55%			
Fan Motor Efficiency	85%			
Sizing Factor	1.00			
Fan Design Load CAV	2.3	W/m^2	0.21	W/ft^2
Fan Design Load VAV	2.3	W/m^2	0.21	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continous	Scheduled	Continuous	Scheduled
Incidence of Use	20%	80%	20%	80%
Comments				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.04	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.003	kW/kW	0.01	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.16	W/m^2	0.02	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.003	L/s.m^2	0.004	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	60%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.002	L/s.m^2	0.0035	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure	30	kPa	10	ft		
Pump Efficiency	60%					
Pump Motor Efficiency	85%					
Sizing Factor	1.0					
Pump Connected Load	0.1	W/m^2	0.01	W/ft^2		

Supply Fan Occ. Period	2200	hrs./year
Supply Fan Unocc. Period	6560	hrs./year
Supply Fan Energy Consumption	7.9	kWh/m^2.yr
Exhaust Fan Occ. Period	2200	hrs./year
Exhaust Fan Unocc. Period	6560	hrs./year
Exhaust Fan Energy Consumption	0.9	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption	0.6	kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	0.9
	MJ/m^2.yr	34.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Education
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 12.7 kWh/ft^2 yr 493.6 MJ/m^2 yr **Gas:** 3.7 kWh/ft^2 yr 144.1 MJ/m^2 yr

END USE:	kWh/ft^2 yr	MJ/m^2 yr
GENERAL (CLASSROOM) LIGHTIN(	1.8	70.9
ARCHITECTURAL LIGHTING	0.4	14.5
HIGH BAY (GYMNASIUM) LIGHTIN(	0.3	11.6
OTHER PLUG LOADS	0.5	19.4
HVAC FANS & PUMPS	0.9	34.2
REFRIGERATION	0.1	5.0
MISCELLANEOUS	0.1	5.0
COMPUTER EQUIPMENT	0.6	23.8
ELEVATORS		
OUTDOOR LIGHTING	0.2	8.5

END USE:	Electricity		Gas	
	kWh/ft^2 yr	MJ/m^2 yr	kWh/ft^2 yr	MJ/m^2 yr
SPACE HEATING	6.5	251.1	3.0	115.0
SPACE COOLING	0.05	1.8		
DOMESTIC HOT WATER	0.9	33.0	0.4	14.1
FOOD SERVICE EQUIPMENT	0.3	10.0	0.4	15.0
MISCELLANEOUS	0.1	5.0		

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant Baseline	All		Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft².°F
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.15			
Shading Coefficient (SC)	0.85			

Typical Building Size	500	m²	5,380	ft²
Typical Footprint (m²)	500	m²	5,380	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	4.5	m	14.8	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	60%							40%	60%
Min. Air Flow (%)					10%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m²/person	538	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	19	L/s.person	40	CFM/person

%OA 13.90%

Fresh Air Control Type *(enter a 1, 2 or 3) 2
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:	40%			
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	2.73	L/s.m²	0.54	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.30	L/s.m²	0.06	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use	50%		50%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	263,743	
Peak Zone Sensible Load	62,254	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	2,896	
Total air circulation or Design air	2.73	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic	60%	90%
DDC/Pneumatic	30%	
All DDC	10%	10%
Total (should add-up to 100%)	100%	100%

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	24	°C	75.2	°F	15	°C	59	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	22	°C	71.6	°F	15	°C	59	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	22	°C	71.6	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year 4

Incidence of Annual Room Controls Maintenance 100.0%

Incidence of Annual HVAC Controls Maintenance 100%

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	100%
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	100%
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Restaurant Baseline	All		Yukon

LIGHTING

GENERAL LIGHTING

Light Level 400 Lux 37.2 ft-candles
Floor Fraction (GLFF) 0.50
Connected Load 9.5 W/m^2 0.9 W/ft^2

Occ. Period(Hrs./yr.) 4300
Unocc. Period(Hrs./yr.) 4460
Usage During Occupied Period 100%
Usage During Unoccupied Period 10%

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	400	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					400

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)					100%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

EUI		
	kWh/ft^2.yr	2.1
	MJ/m^2.yr	81

ARCHITECTURAL LIGHTING

Light Level 300 Lux 27.9 ft-candles
Floor Fraction (ALFF) 0.50
Connected Load 20.9 W/m^2 1.9 W/ft^2

Occ. Period(Hrs./yr.) 4300
Unocc. Period(Hrs./yr.) 4460
Usage During Occupied Period 100%
Usage During Unoccupied Period 10%

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	82	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI		
	kWh/ft^2.yr	4.6
	MJ/m^2.yr	178

OTHER (HIGH BAY) LIGHTING

Light Level Lux ft-candles
Floor Fraction (HBLFF)
Connected Load W/m^2 W/ft^2

Floor fraction check: should = 1.00 1.00

Occ. Period(Hrs./yr.) 4000
Unocc. Period(Hrs./yr.) 4760
Usage During Occupied Period 0%
Usage During Unoccupied Period 100%

Fixture Cleaning:
Incidence of Practice
Interval years

Relamping Strategy & Incidence of Practice: Group | Spot

Light Level (Lux)	300	500	700	1000	Total
% Distribution					
Weighted Average					

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	HPS	TOTAL
System Present (%)							0%	0.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI		
	kWh/ft^2.yr	
	MJ/m^2.yr	

TOTAL LIGHTING

Overall LP 15.17 W/m^2

EUI TOTAL		
	kWh/ft^2.yr	6.7
	MJ/m^2.yr	259

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	55		51		100		200		217			
Density (device/occupant)	0.36		0.36		0.01				0.03			
Connected Load	0.4	W/m^2	0.4	W/m^2	0.0	W/m^2		W/m^2	0.1	W/m^2	1.15	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2		W/ft^2	0.01	W/ft^2	0.11	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		50%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		4100	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		4660	

Total end-use load (occupied period) 1.9 W/m^2 0.2 W/ft^2
Total end-use load (unocc. period) 1.1 W/m^2 0.1 W/ft^2

Usage during occupied period 100%
Usage during unoccupied period 59%

	EUI		
Computer Equipment	EUI	kWh/ft^2.yr	0.49
		MJ/m^2.yr	18.95
Plug Loads	EUI	kWh/ft^2.yr	0.64
		MJ/m^2.yr	24.92

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 75.0% Electricity Fuel Share: 25.0%

Cooking

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft^2.yr	23.2	EUI	kWh/ft^2.yr	16.8
	MJ/m^2.yr	900.0		MJ/m^2.yr	650.0

REFRIGERATION

Provide description below:

Walk-ins, reach ins, fridges etc

EUI		
	kWh/ft^2.yr	9.0
	MJ/m^2.yr	350.0

MISCELLANEOUS

EUI		
	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Restaurant
Baseline

SIZE:
All

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel			Electric				
	Boilers Stan.	Boilers High	Packaged Unit	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	3%	2%	15%		10%		70%	100%
Eff./COP	80%	85%	77%	250%	350%	80%	1.00	
Performance (1 / Eff.) (kW/kW)	1.25	1.18	1.30	0.40	0.29	1.25	1.00	

100%

Peak Heating Load 35.3 W/m^2 11.2 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 393 MJ/m^2.yr 10.2 kWh/ft^2.yr
Sizing Factor 1.00
Electric Fuel Share 80.0% Fossil Fuel Share 20.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	10.2
MJ/m^2.yr	393

Natural Gas EUI	
kWh/ft^2.yr	10.0
MJ/m^2.yr	387

Market Composite EUI	
kWh/ft^2.yr	10.1
MJ/m^2.yr	392

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Recprocting Chillers		Gas Cooling		Total
	Standard	HE		Open	DX	Absorption	Engine	
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	3	0.9	1.8	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.33	1.11	0.56	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water	100%	
Condenser Water	100%	

Setpoint

	°C	°F
Chilled Water	6	42.8
Condenser Water	35	95
Supply Air	15.0	59

Peak Cooling Load 155 W/m^2 49 Btu/hr.ft^2 245 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 71.7 MJ/m^2.yr 1.9 kWh/ft^2.yr
Sizing Factor 1.00 Operation (occ. period) 3000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 80.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit	100%	2
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.8
MJ/m^2.yr	29

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.8
MJ/m^2.yr	29

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Standard Boiler	Tank Heater	Tank Heater	Cnd. Boiler	Water Heater
System Present (%)			20%		
Eff./COP	75%	60%	70%	90%	90%

	Fossil		Elec. Res.
Fuel Share	20%		80%
Blended Efficiency	0.70		0.91

100%

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 400.0
Wetting Use Percentage 10%

All Electric EUI	
kWh/ft^2.yr	11.3
MJ/m^2.yr	440

All Natural Gas EUI	
kWh/ft^2.yr	14.8
MJ/m^2.yr	571

Market Composite EUI	
kWh/ft^2.yr	12.0
MJ/m^2.yr	465.9

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**All**		**Yukon**
Baseline			

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	2.7	L/s.m^2	0.54	CFM/ft^2
System Static Pressure CAV	500	Pa	2.0	wg
System Static Pressure VAV	625	Pa	2.5	wg
Fan Efficiency	52%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	3.3	W/m^2	0.31	W/ft^2
Fan Design Load VAV	4.1	W/m^2	0.38	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continous	Scheduled	Continuous	Scheduled
Incidence of Use	90%	10%	100%	
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.4	L/s.m^2	0.08	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.5	L/s.m^2	0.10	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	72%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.7	W/m^2	0.06	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.022	kW/kW	0.08	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	3.42	W/m^2	0.32	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.008	L/s.m^2	0.012	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	60%			
Pump Motor Efficiency	85%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.007	L/s.m^2	0.0098	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	60%					
Pump Motor Efficiency	85%					
Sizing Factor	1.0					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	3900	hrs./year
Supply Fan Unocc. Period	4860	hrs./year
Supply Fan Energy Consumption	27.2	kWh/m^2.yr
Exhaust Fan Occ. Period	3900	hrs./year
Exhaust Fan Unocc. Period	4860	hrs./year
Exhaust Fan Energy Consumption	6.1	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.4	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	3.1
	MJ/m^2.yr	121.4

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:**	**REGION:**
Restaurant	**All**		**Yukon**
Baseline			

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 44.7 kWh/ft².yr 1,731.6 MJ/m².yr **Gas:** 22.4 kWh/ft².yr 866.8 MJ/m².yr

END USE:	kWh/ft².yr	MJ/m².yr
GENERAL LIGHTING	2.1	80.9
ARCHITECTURAL LIGHTING	4.6	178.4
OTHER (HIGH BAY) LIGHTING		
OTHER PLUG LOADS	0.6	24.9
HVAC FANS & PUMPS	3.1	121.4
REFRIGERATION	9.0	350.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	18.9
ELEVATORS		
OUTDOOR LIGHTING	2.2	84.8

END USE:	Electricity		Gas	
	kWh/ft².yr	MJ/m².yr	kWh/ft².yr	MJ/m².yr
SPACE HEATING	8.1	314.8	2.0	77.5
SPACE COOLING	0.6	23.4		
DOMESTIC HOT WATER	9.1	351.6	3.0	114.3
FOOD SERVICE EQUIPMENT	4.2	162.5	17.4	675.0
MISC.	0.3	10.0		
			20.4	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	**SIZE:**	**VINTAGE:** New	**REGION:**
Rec Centre			**Yukon**
Baseline			

CONSTRUCTION

Wall U value (W/m^2.°C)	0.20	W/m^2.°C	0.04	Btu/hr.ft^2.°F	Typical Building Size	1,859	m^2	20,000	ft^2
Roof U value (W/m^2.°C)	0.11	W/m^2.°C	0.02	Btu/hr.ft^2.°F	Typical Footprint (m^2)	1,859	m^2	20,000	ft^2
Glazing U value (W/m^2.°C)	1.60	W/m^2.°C	0.28	Btu/hr.ft^2.°F	Footprint Aspect Ratio (L:W)	1			
					Percent Conditioned Space	100%			
					Percent Conditioned Space Defined as Exterior Zone	50%			
Window/Wall Ratio (WIWAR) (%)	0.05								
Shading Coefficient (SC)	0.80				Typical # Stories	1			
					Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	50	m^2/person	538	ft^2/person	%OA	21.47%
Occupancy Schedule Occ. Period	90%					
Occupancy Schedule Unocc. Period						
Fresh Air Requirements or Outside Air	10	L/s.person	21	CFM/person		

Fresh Air Control Type *(enter a 1, 2 or 3) | 1 |
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right:				
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m^2	0.10	CFM/ft^2
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.93	L/s.m^2	0.18	CFM/ft^2
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.40	L/s.m^2	0.08	CFM/ft^2

Separate Make-up air unit (100% OA)		L/s.m^2		CFM/ft^2
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg.	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	160,296	
Peak Zone Sensible Load	78,854	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft^3/lbm
Design CFM	3,668	
Total air circulation or Design air	0.93	l/s.m^2

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg.	28.2	Btu/lbm	54.5	KJ/kg.	23.4	Btu/lbm
Winter Occ. Temperature	16	°C	60.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg.	22.8	Btu/lbm	45.5	KJ/kg.	19.6	Btu/lbm
Winter Unocc. Temperature	16	°C	60.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg.	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning — Changes/Year: ☐

Incidence of Annual Room Controls Maintenance: ☐

Incidence of Annual HVAC Controls Maintenance: ☐

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:New	REGION:
Rec Centre			Yukon
Baseline			

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.20			
Connected Load	9.5	W/m^2	0.9	W/ft^2

Occ. Period(Hrs./yr.)	3500
Unocc. Period(Hrs./yr.)	5260
Usage During Occupied Period	100%
Usage During Unoccupied Period	15%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%			100%
Weighted Average					400

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)					100%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	0.8
	MJ/m^2.yr	29

SECONDARY LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	13.2	W/m^2	1.2	W/ft^2

Occ. Period(Hrs./yr.)	3000
Unocc. Period(Hrs./yr.)	5760
Usage During Occupied Period	100%
Usage During Unoccupied Period	15%

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)		100%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.2
	MJ/m^2.yr	9

TERTIARY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.75			
Connected Load	11.1	W/m^2	1.0	W/ft^2

Floor fraction check: should = 1.00	1.00

Occ. Period(Hrs./yr.)	3300
Unocc. Period(Hrs./yr.)	5460
Usage During Occupied Period	90%
Usage During Unoccupied Period	15%

Light Level (Lux)	200	300	400	1000	Total
% Distribution	25%	50%	25%		100%
Weighted Average					300

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						25%	75%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

Fixture Cleaning:

Incidence of Practice		
Interval		years

Relamping Strategy & Incidence of Practice	Group	Spot

EUI	kWh/ft^2.yr	2.9
	MJ/m^2.yr	113

TOTAL LIGHTING

Overall LP 2.55 W/m^2

EUI TOTAL	kWh/ft^2.yr	3.9
	MJ/m^2.yr	152

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	54.55		51		100		200		217			
Density (device/occupant)	0.05		0.05									
Connected Load	0.1	W/m^2	0.1	W/m^2		W/m^2		W/m^2		W/m^2	1	W/m^2
	0.0	W/ft^2	0.0	W/ft^2		W/ft^2		W/ft^2		W/ft^2	0.09	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		3500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		5260	

Total end-use load (occupied period)	1.0	W/m^2	0.1	W/ft^2
Total end-use load (unocc. period)	0.3	W/m^2	0.0	W/ft^2

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Usage during occupied period	100%
Usage during unoccupied period	30%

Computer Equipment	EUI	kWh/ft^2.yr	0.05
		MJ/m^2.yr	1.96
Plug Loads	EUI	kWh/ft^2.yr	0.41
		MJ/m^2.yr	16.07

FOOD SERVICE EQUIPMENT

Provide description below: Gas Fuel Share: 10.0% Electricity Fuel Share: 90.0%

Natural Gas EUI		
EUI	kWh/ft^2.yr	0.6
	MJ/m^2.yr	25.0

All Electric EUI		
EUI	kWh/ft^2.yr	0.6
	MJ/m^2.yr	25.0

REFRIGERATION

Provide description below:

Refrigeration Plant and Auxiliaries

Artificial Ice Saturation: 100.0%

EUI	kWh/ft^2.yr	7.0
	MJ/m^2.yr	271.2

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Rec Centre
Baseline

SIZE:

VINTAGE: New

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Fossil Fuel						Electric	
	Boilers Stan.	Boilers High	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	10%	10%	30%				50%	100%
Eff./COP	80%	85%	78%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.25	1.18	1.28	0.59	0.33	0.22	1.00	

Peak Heating Load	29.7 W/m^2	9.4 Btu/hr.ft^2	
Seasonal Heating Load (Tertiary Load)	336 MJ/m^2.yr	8.7 kWh/ft^2.yr	
Sizing Factor	1.00		
Electric Fuel Share	50.0%	Gas Fuel Share	50.0%
Space Heat Saturation (Incidence of SPC HT)	70.0%		

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	8.7
MJ/m^2.yr	336

Natural Gas EUI	
kWh/ft^2.yr	10.9
MJ/m^2.yr	421

Market Composite EUI	
kWh/ft^2.yr	9.8
MJ/m^2.yr	378

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE	Chillers	Open	DX	W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.34	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7 °C	44.6 °F
Condenser Water	30 °C	86 °F
Supply Air	13.0 °C	55.4 °F

Peak Cooling Load	25 W/m^2	8 Btu/hr.ft^2	1497 ft^2/Ton
Seasonal Cooling Load (Tertiary Load)	14.3 MJ/m^2.yr	0.4 kWh/ft^2.yr	
Sizing Factor	1.00		
A/C Saturation (Incidence of A/C)	5.0%		
Electric Fuel Share	100.0%	Gas Fuel Share	

Operation (occ. perio 3000 hrs/year Note value cannot be less than 2,900 hrs/year)

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	4

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	4

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)		30%	5%	10%	
Eff./COP	0.55	0.70	0.90	0.80	0.90

	Fossil		Elec. Res.
Fuel Share	45%		55%
Blended Efficiency	0.74		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load)	80.0
Wetting Use Percentage	50%

Incidence of Heat recr'y	40%
Heat recr'y load share	50%

All Electric EUI	
kWh/ft^2.yr	2.3
MJ/m^2.yr	88

Natural Gas EUI	
kWh/ft^2.yr	2.8
MJ/m^2.yr	107

Market Composite EUI	
kWh/ft^2.yr	2.5
MJ/m^2.yr	96.7

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **Rec Centre** **Baseline**	**SIZE:**	**VINTAGE:** New	**REGION:** **Yukon**

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.9	L/s.m^2	0.18	CFM/ft^2
System Static Pressure CAV	300	Pa	1.2	wg
System Static Pressure VAV	300	Pa	1.2	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	0.6	W/m^2	0.05	W/ft^2
Fan Design Load VAV	0.6	W/m^2	0.05	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuou	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.02	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.04	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.3	W/m^2	0.03	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.51	W/m^2	0.05	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.001	L/s.m^2	0.002	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m^2	0.0016	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	3.6	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.7	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	0.5
	MJ/m^2.yr	19.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Rec Centre
Baseline

SIZE:

VINTAGE: New

REGION:
Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 18.1 kWh/ft^2·yr 701.0 MJ/m^2·yr **Gas:** 5.1 kWh/ft^2·yr 198.2 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	0.8	29.2
SECONDARY LIGHTING	0.2	9.2
TERTIARY LIGHTING	2.9	113.3
OTHER PLUG LOADS	0.4	16.1
HVAC FANS & PUMPS	0.5	19.2
REFRIGERATION	7.0	271.2
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.1	2.0
ELEVATORS		
OUTDOOR LIGHTING	1.1	42.4

END USE:	Electricity		Gas	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	3.0	117.4	3.8	147.3
SPACE COOLING	0.0	0.2		
DOMESTIC HOT WATER	1.2	48.4	1.2	48.4
FOOD SERVICE EQUIPMENT	0.6	22.5	0.1	2.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:	SIZE:	VINTAGE:	REGION:
Warehouse/Wholesale Baseline			Yukon

CONSTRUCTION

Wall U value (W/m².°C)	0.20	W/m².°C	0.04	Btu/hr.ft².°F
Roof U value (W/m².°C)	0.11	W/m².°C	0.02	Btu/hr.ft².°F
Glazing U value (W/m².°C)	1.60	W/m².°C	0.28	Btu/hr.ft².°F
Window/Wall Ratio (WIWAR) (%)	0.05			
Shading Coefficient (SC)	0.80			

Typical Building Size	3,253	m²	35,000	ft²
Typical Footprint (m²)	3,253	m²	35,000	ft²
Footprint Aspect Ratio (L:W)	1			
Percent Conditioned Space	100%			
Percent Conditioned Space Defined as Exterior Zone	40%			
Typical # Stories	1			
Floor to Floor Height (m)	6.1	m	19.9	ft

VENTILATION SYSTEM, BUILDING CONTROLS & INDOOR CONDITIONS

Ventilation System Type

	CAV	CAVR	DDMZ	DDMZVV	VAV	VAVR	IU	100% O.A	TOTAL
System Present (%)	100%								100%
Min. Air Flow (%)					50%				

(Minimum Throttled Air Volume as Percent of Full Flow)

Occupancy or People Density	100	m²/person	1076	ft²/person
Occupancy Schedule Occ. Period	90%			
Occupancy Schedule Unocc. Period				
Fresh Air Requirements or Outside Air	25	L/s.person	53	CFM/person

%OA 30.70%

Fresh Air Control Type *(enter a 1, 2 or 3) 1
(1 = mixed air control, 2 = Fixed fresh air, 3 100% fresh air)

If Fresh Air Control Type = "2" enter % FA. to the right				
If Fresh Air Control Type = "3" enter Make-up Air Ventilation and operation	0.5	L/s.m²	0.10	CFM/ft²
	50%	operation (%)		

Sizing Factor	1			
Total Air Circulation or Design Air Flow	0.81	L/s.m²	0.16	CFM/ft²
Infiltration Rate (air infiltration is assumed to occur during unoccupied hours only if the ventilation system shuts down)	0.40	L/s.m²	0.08	CFM/ft²

Separate Make-up air unit (100% OA)		L/s.m²		CFM/ft²
Operation occupied period	50%			
Operation unoccupied period	50%			

Economizer

	Enthalpy Based		Dry-Bulb Based		Total
Incidence of Use			100%		100%
Switchover Point		KJ/kg	18	°C	
		Btu/lbm	64.4	°F	

Summary of Design Parameters		
Peak Design Cooling Load	287,602	
Peak Zone Sensible Load	120,647	
Room air enthalpy	28.2	Btu/lbm
Discharge air enthalpy	23.4	Btu/lbm
Specific volume of air at 55F & 100% R	13.2	ft³/lbm
Design CFM	5,612	
Total air circulation or Design air	0.81	l/s.m²

Controls Type

System Present (%)	HVAC Equipment	Room Controls
All Pneumatic		
DDC/Pneumatic		
All DDC		
Total (should add-up to 100%)		

Control mode

	Proportional		PI / PID	Total
Control Mode				
	Fixed Discharge		Reset	
Control Strategy				

Indoor Design Conditions

	Room				Supply Air			
Summer Temperature	22	°C	71.6	°F	13	°C	55.4	°F
Summer Humidity (%)	50%				100%			
Enthalpy	65.5	KJ/kg	28.2	Btu/lbm	54.5	KJ/kg	23.4	Btu/lbm
Winter Occ. Temperature	21	°C	69.8	°F	16	°C	60.8	°F
Winter Occ. Humidity	30%				45%			
Enthalpy	53	KJ/kg	22.8	Btu/lbm	45.5	KJ/kg	19.6	Btu/lbm
Winter Unocc. Temperature	21	°C	69.8	°F				
Winter Unocc. Humidity	30%							
Enthalpy	50	KJ/kg	21.5	Btu/lbm				

Damper Maintenance

	Incidence (%)	Frequency (years)
Control Arm Adjustment		
Lubrication		
Blade Seal Replacement		

Air Filter Cleaning Changes/Year

Incidence of Annual Room Controls Maintenance

Incidence of Annual HVAC Controls Maintenance

Annual Maintenance Tasks	Incidence (%)
Calibration of Transmitters	
Calibration of Panel Gauges	
Inspection of Auxiliary Devices	
Inspection of Control Devices	

Annual Maintenance Tasks	Incidence (%)
Inspection/Calibration of Room Thermostat	
Inspection of PE Switches	
Inspection of Auxiliary Devices	
Inspection of Control Devices (Valves, (Dampers, VAV Boxes)	

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Warehouse/Wholesale
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

LIGHTING

GENERAL LIGHTING

Light Level	400	Lux	37.2	ft-candles
Floor Fraction (GLFF)	0.15			
Connected Load	9.5	W/m^2	0.9	W/ft^2
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & Incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	50%	50%			100%
Weighted Average					**400**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)					100%			100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.7	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	0.5
	MJ/m^2.yr	19

SECONDARY LIGHTING

Light Level	300	Lux	27.9	ft-candles
Floor Fraction (ALFF)	0.05			
Connected Load	20.9	W/m^2	1.9	W/ft^2
Occ. Period(Hrs./yr.)	3000			
Unocc. Period(Hrs./yr.)	5760			
Usage During Occupied Period	90%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & incidence of Practice	Group	Spot		

Light Level (Lux)	300	500	700	1000	Total
% Distribution	100%				100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)	25%	75%						100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI = Load X Hrs. X SF X GLFF

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	13

TERTIARY LIGHTING

Light Level	300.00	Lux	27.9	ft-candles
Floor Fraction (HBLFF)	0.80			
Connected Load	12.0	W/m^2	1.1	W/ft^2
Occ. Period(Hrs./yr.)	3300			
Unocc. Period(Hrs./yr.)	5460			
Usage During Occupied Period	100%			
Usage During Unoccupied Period	15%			
Fixture Cleaning:				
Incidence of Practice				
Interval		years		
Relamping Strategy & incidence of Practice	Group	Spot		

Floor fraction check: should = 1.00 | 1.00

Light Level (Lux)	200	300	400	1000	Total
% Distribution	25%	50%	25%		100%
Weighted Average					**300**

	INC	CFL	T12 ES	T8 Mag	T8 Elec	MH	T5 HO	TOTAL
System Present (%)						50%	50%	100.0%
CU	0.7	0.7	0.6	0.6	0.6	0.6	0.6	
LLF	0.65	0.65	0.75	0.80	0.80	0.55	0.55	
Efficacy (L/W)	15	50	72	84	88	65	90	

EUI	kWh/ft^2.yr	3.7
	MJ/m^2.yr	143

TOTAL LIGHTING

Overall LP 12.10 W/m^2

EUI TOTAL	kWh/ft^2.yr	4.5
	MJ/m^2.yr	176

OFFICE EQUIPMENT & PLUG LOADS

Equipment Type	Computers		Monitors		Printers		Copiers		Servers		Plug Loads	
Measured Power (W/device)	54.55		51		100		200		217			
Density (device/occupant)	0.59		0.59		0.03		0.03		0.06			
Connected Load	0.3	W/m^2	0.3	W/m^2	0.0	W/m^2	0.1	W/m^2	0.1	W/m^2	1	W/m^2
	0.0	W/ft^2	0.0	W/ft^2	0.00	W/ft^2	0.01	W/ft^2	0.01	W/ft^2	0.09	W/ft^2
Diversity Occupied Period	90%		90%		90%		90%		100%		90%	
Diversity Unoccupied Period	50%		50%		50%		50%		100%		25%	
Operation Occ. Period (hrs./year)	2000		2000		2000		2000		2000		3500	
Operation Unocc. Period (hrs./year)	6760		6760		6760		6760		6760		5260	

Total end-use load (occupied period)	1.7	W/m^2	0.2	W/ft^2
Total end-use load (unocc. period)	0.7	W/m^2	0.1	W/ft^2
Usage during occupied period	100%			
Usage during unoccupied period	44%			

to see notes (cells with red indicator in upper right corner, type "SHIFT F2"

Computer Equipment	EUI	kWh/ft^2.yr	0.46
		MJ/m^2.yr	17.72
Plug Loads	EUI	kWh/ft^2.yr	0.41
		MJ/m^2.yr	16.07

FOOD SERVICE EQUIPMENT

Provide description below:

Gas Fuel Share:

Electricity Fuel Share: 100.0%

Natural Gas EUI			All Electric EUI		
EUI	kWh/ft^2.yr	0.1	EUI	kWh/ft^2.yr	0.1
	MJ/m^2.yr	5.0		MJ/m^2.yr	4.0

REFRIGERATION

Provide description below:

Large refrigeration storage

EUI	kWh/ft^2.yr	1.8
	MJ/m^2.yr	70.0

MISCELLANEOUS

EUI	kWh/ft^2.yr	0.3
	MJ/m^2.yr	10

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS:
Warehouse/Wholesale
Baseline

SIZE:

VINTAGE:

REGION:
Yukon

SPACE HEATING

Heating Plant Type

	Hot Water System						Electric	
	Boiler	Unit Heater	Packaged Units	A/A HP	W. S. HP	H/R Chiller	Resistance	Total
System Present (%)	15%		35%				50%	100%
Eff./COP	75%	75%	77%	1.70	3.00	4.50	1.00	
Performance (1 / Eff.) (kW/kW)	1.33	1.33	1.30	0.59	0.33	0.22	1.00	

Peak Heating Load 29.2 W/m^2 9.3 Btu/hr.ft^2
Seasonal Heating Load (Tertiary Load) 393 MJ/m^2.yr 10.1 kWh/ft^2.yr
Sizing Factor 1.00
Electric Fuel Share 50.0% Fossil Fuel Share 50.0%

Boiler Maintenance

Annual Maintenance Tasks	Incidence (%)
Fire Side Inspection	75%
Water Side Inspection for Scale Buildup	100%
Inspection of Controls & Safeties	100%
Inspection of Burner	100%
Flue Gas Analysis & Burner Set-up	90%

All Electric EUI	
kWh/ft^2.yr	10.1
MJ/m^2.yr	393

Natural Gas EUI	
kWh/ft^2.yr	13.3
MJ/m^2.yr	514

Market Composite EUI	
kWh/ft^2.yr	11.7
MJ/m^2.yr	454

SPACE COOLING

A/C Plant Type

	Centrifugal Chillers		Screw Chillers	Reciprocating Chillers		Absorption Chillers		Total
	Standard	HE		Open	DX	W. H.	CW	
System Present (%)					100.0%			100.0%
COP	4.7	5.4	4.4	3.6	2.9	0.9	1	
Performance (1 / COP) (kW/kW)	0.21	0.19	0.23	0.28	0.34	1.11	1.00	
Additional Refrigerant Related Information								

Control Mode

Incidence of Use	Fixed Setpoint	Reset
Chilled Water		
Condenser Water		

Setpoint

Chilled Water	7	°C	44.6	°F
Condenser Water	30	°C	86	°F
Supply Air	13.0	°C	55.4	°F

Peak Cooling Load 26 W/m^2 8 Btu/hr.ft^2 1460 ft^2/Ton
Seasonal Cooling Load (Tertiary Load) 13.8 MJ/m^2.yr 0.4 kWh/ft^2.yr
Sizing Factor 1.00 Operation (occ. perio 4000 hrs/year Note value cannot be less than 2,900 hrs/year)
A/C Saturation (Incidence of A/C) 5.0%
Electric Fuel Share 100.0% Gas Fuel Share

Chiller Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect Control, Safeties & Purge Unit		
Inspect Coupling, Shaft Sealing and Bearings		
Megger Motors		
Condenser Tube Cleaning		
Vibration Analysis		
Eddy Current Testing		
Spectrochemical Oil Analysis		

Cooling Tower/Air Cooled Condenser Maintenan

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspection/Clean Spray Nozzles		
Inspect/Service Fan/Fan Motors		
Megger Motors		
Inspect/Verify Operation of Controls		

All Electric EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	5

Natural Gas EUI	
kWh/ft^2.yr	
MJ/m^2.yr	

Market Composite EUI	
kWh/ft^2.yr	0.1
MJ/m^2.yr	5

DOMESTIC HOT WATER

Service Hot Water Plant Type

Fossil Fuel SHW	Std. Tank	HE Tank	Cond. Tnk	Std. Boiler	Cnd. Boil.
System Present (%)	25%	5%			
Eff./COP	55%	70%	90%	75%	90%

	Fossil		Elec. Res.
Fuel Share	30%		70%
Blended Efficiency	0.58		0.91

Service Hot Water load (MJ/m^2.yr) (Tertiary Load) 18.2
Wetting Use Percentage 90%

All Electric EUI	
kWh/ft^2.yr	0.5
MJ/m^2.yr	20

Natural Gas EUI	
kWh/ft^2.yr	0.8
MJ/m^2.yr	32

Market Composite EUI	
kWh/ft^2.yr	0.6
MJ/m^2.yr	23.5

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: **SIZE:** **VINTAGE:** **REGION:**

Warehouse/Wholesale
Baseline
Yukon

HVAC FANS & PUMPS

SUPPLY FANS

System Design Air Flow	0.8	L/s.m^2	0.16	CFM/ft^2
System Static Pressure CAV	300	Pa	1.2	wg
System Static Pressure VAV	300	Pa	1.2	wg
Fan Efficiency	60%			
Fan Motor Efficiency	80%			
Sizing Factor	1.00			
Fan Design Load CAV	0.5	W/m^2	0.05	W/ft^2
Fan Design Load VAV	0.5	W/m^2	0.05	W/ft^2

Ventilation and Exhaust Fan Operation & Control

	Ventilation Fan		Exhaust Fan	
Control	Fixed	Variable Flow	Fixed	Variable Flow
Incidence of Use	100%		100%	
Operation	Continuous	Scheduled	Continuous	Scheduled
Incidence of Use	50%	50%	50%	50%
Comments:				

EXHAUST FANS

Washroom Exhaust	100	L/s.washroom	212	CFM/washroom
Washroom Exhaust per gross unit are	0.1	L/s.m^2	0.01	CFM/ft^2
Other Exhaust (Smoking/Conference)	0.1	L/s.m^2	0.02	CFM/ft^2
Total Building Exhaust	0.2	L/s.m^2	0.03	CFM/ft^2
Exhaust System Static Pressure	250	Pa	1.0	wg
Fan Efficiency	25%			
Fan Motor Efficiency	75%			
Sizing Factor	1.0			
Exhaust Fan Connected Load	0.2	W/m^2	0.02	W/ft^2

AUXILIARY COOLING EQUIPMENT (Condenser Pump and Cooling Tower/Condenser Fans)

Average Condenser Fan Power Draw	0.020	kW/kW	0.07	kW/Ton
(Cooling Tower/Evap. Condenser/ Air Cooled Condenser)	0.52	W/m^2	0.05	W/ft^2

Condenser Pump

Pump Design Flow	0.053	L/s.KW	3.0	U.S. gpm/Ton
Pump Design Flow per unit floor area	0.001	L/s.m^2	0.002	U.S. gpm/ft^2
Pump Head Pressure		kPa		ft
Pump Efficiency	50%			
Pump Motor Efficiency	80%			
Sizing Factor	1.0			
Pump Connected Load		W/m^2		W/ft^2

CIRCULATING PUMP (Heating & Cooling)

Pump Design Flow @ 5 °C (10 °F) delta T	0.001	L/s.m^2	0.0016	U.S. gpm/ft^2	2.4	U.S. gpm/Ton
Pump Head Pressure		kPa		ft		
Pump Efficiency	50%					
Pump Motor Efficiency	80%					
Sizing Factor	0.8					
Pump Connected Load		W/m^2		W/ft^2		

Supply Fan Occ. Period	3500	hrs./year
Supply Fan Unocc. Period	5260	hrs./year
Supply Fan Energy Consumption	3.1	kWh/m^2.yr
Exhaust Fan Occ. Period	3500	hrs./year
Exhaust Fan Unocc. Period	5260	hrs./year
Exhaust Fan Energy Consumption	1.3	kWh/m^2.yr
Condenser Pump Energy Consumption		kWh/m^2.yr
Cooling Tower /Condenser Fans Energy Consumption	0.1	kWh/m^2.yr
Circulating Pump Yearly Operation	7000	hrs./year
Circulating Pump Energy Consumption		kWh/m^2.yr

Fans and Pumps Maintenance

Annual Maintenance Tasks	Incidence (%)	Frequency (years)
Inspect/Service Fans & Motors		
Inspect/Adjust Belt Tension on Fan Belts		
Inspect/Service Pump & Motors		

EUI	kWh/ft^2.yr	0.4
	MJ/m^2.yr	16.2

COMMERCIAL SECTOR BUILDING PROFILE

NEW BUILDINGS: Warehouse/Wholesale Baseline

SIZE:

VINTAGE:

REGION: Yukon

EUI SUMMARY

TOTAL ALL END-USES: **Electricity:** 13.9 kWh/ft^2·yr 537.3 MJ/m^2·yr **Gas:** 6.9 kWh/ft^2·yr 266.6 MJ/m^2·yr

END USE:	kWh/ft^2·yr	MJ/m^2·yr
GENERAL LIGHTING	0.5	19.4
SECONDARY LIGHTING	0.3	13.4
TERTIARY LIGHTING	3.7	142.9
OTHER PLUG LOADS	0.4	16.1
HVAC FANS & PUMPS	0.4	16.2
REFRIGERATION	1.8	70.0
MISCELLANEOUS	0.3	10.0
COMPUTER EQUIPMENT	0.5	17.7
ELEVATORS		
OUTDOOR LIGHTING	0.4	17.0

END USE:	Electricity		Gas	
	kWh/ft^2·yr	MJ/m^2·yr	kWh/ft^2·yr	MJ/m^2·yr
SPACE HEATING	5.1	196.4	6.6	257.1
SPACE COOLING	0.0	0.3		
DOMESTIC HOT WATER	0.4	14.0	0.2	9.5
FOOD SERVICE EQUIPMENT	0.1	4.0		

Terms Used in Building Profile Summaries

Profile Term	Explanation
Building envelope	Defines the thermal characteristics of a building's exterior components
U-value	The rate of heat loss, in Btu per hour per square foot per degree Fahrenheit (BTU/hr. f^2.°F) through walls, roofs and windows. The U-value is the reciprocal of the R-value
Shading coefficient (SC)	Is a measure of the total amount of heat passing through the glazing compared with that through a single clear glass
Window-to-wall ratio	Defines the ratio of window to insulated exterior wall area
General lighting	Defines the lighting types that are used within the main areas of a building, e.g., for a School, the area is classrooms and the lighting type is fluorescent; for a Food Retail store, the main area is the retail floor.
LPD	Lighting power density expressed in terms of W/ft^2
Lux	The amount of visible light per square meter incident on a surface (lumen/m^2)
Inc	Incandescent lamps
CFL	Compact fluorescent lamps
T12	T12 fluorescent lamps with magnetic ballasts
T8	T8 fluorescent lamps with electronic ballasts
MH	Metal halide lamps
HPS	High-pressure sodium lamps
HID	High-intensity discharge lighting includes both MH and HPS
Secondary lighting	Defines the lighting types that are used within the secondary areas of a building, e.g., for a School, the secondary areas are corridors, lobbies, foyers, etc.,
Tertiary lighting	Defines the lighting types that are used within special purpose areas of a building, e.g., for a School, the tertiary area is a gymnasium.
Outdoor lighting	Defines the outdoor lighting including parking lot and façade
Overall LPD	The total floor weighted LPD that includes general, secondary, tertiary, and outdoor.
Fans	Defines mix of air handling systems
CAV	Constant air volume
VAV	Variable air volume
space heating	Defines the mix of heating equipment types found within the stock of buildings
ASHP	Air-source heat pump
WSHP	Water-source heat pump
Resistance	Electric resistance heating equipment including boilers and baseboard heaters
Natural gas	Natural gas heating equipment including packaged rooftop units and boilers
Space cooling	Defines the mix of cooling equipment types found within the stock of buildings
Centrifugal	Standard centrifugal chillers with a full load performance of 0.75 kW/ton
Centri HE	High-efficiency centrifugal chillers assumed to have a performance of <0.65 kW/ton
Recip open	Semi-hermetic reciprocating chillers
DX	Direct expansion cooling equipment that use small tonnage hermetic R-22 compressors

Appendix D Background-Section 6: Reference Case Peak Load

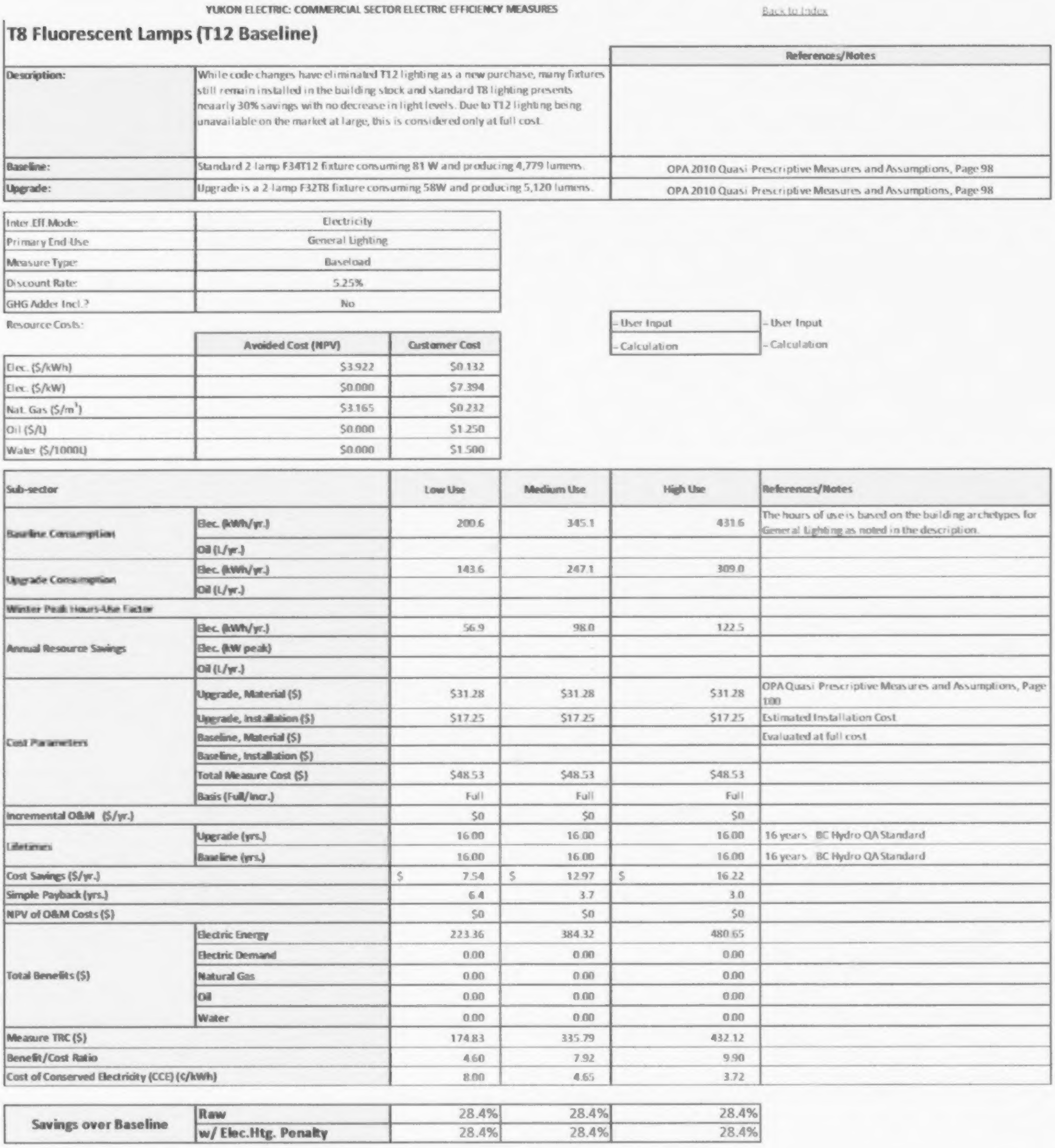
No additional data. As noted in the main text, the same method and hours-use factors that were used for the Base Year calculation were applied to the Reference Case electricity values.

Appendix E Background-Section 7: Technology Assessment - Energy-efficiency Measures

Introduction

Exhibit E 1 provides an example of part of the worksheet that calculates the CCE for T8 fluorescent lamps, one of the analyzed measures. For more detail on this and all the other measures, refer to the measure TRC model Excel workbooks submitted with this report.

Exhibit E 1 Sample Measure CCE Calculation Worksheet



YUKON ELECTRIC: COMMERCIAL SECTOR ELECTRIC EFFICIENCY MEASURES

Back to Index

T8 Fluorescent Lamps (T12 Baseline)

		References/Notes
Description:	While code changes have eliminated T12 lighting as a new purchase, many fixtures still remain installed in the building stock and standard T8 lighting presents neaarly 30% savings with no decrease in light levels. Due to T12 lighting being unavailable on the market at large, this is considered only at full cost.	
Baseline:	Standard 2 lamp F34T12 fixture consuming 81 W and producing 4,779 lumens.	OPA 2010 Quasi Prescriptive Measures and Assumptions, Page 98
Upgrade:	Upgrade is a 2 lamp F32T8 fixture consuming 58W and producing 5,120 lumens.	OPA 2010 Quasi Prescriptive Measures and Assumptions, Page 98

Inter.Eff.Mode:	Electricity
Primary End-Use:	General Lighting
Measure Type:	Baseload
Discount Rate:	5.25%
GHG Adder Incl.?	No

Resource Costs:

	Avoided Cost (NPV)	Customer Cost
Elec. ($/kWh)	$3.922	$0.132
Elec. ($/kW)	$0.000	$7.394
Nat. Gas ($/m^3)	$3.165	$0.232
Oil ($/L)	$0.000	$1.250
Water ($/1000L)	$0.000	$1.500

- User Input	- User Input
- Calculation	- Calculation

Sub-sector		Low Use	Medium Use	High Use	References/Notes
Baseline Consumption	Elec. (kWh/yr.)	200.6	345.1	431.6	The hours of use is based on the building archetypes for General Lighting as noted in the description.
	Oil (L/yr.)				
Upgrade Consumption	Elec. (kWh/yr.)	143.6	247.1	309.0	
	Oil (L/yr.)				
Winter Peak Hours-Use Factor					
Annual Resource Savings	Elec. (kWh/yr.)	56.9	98.0	122.5	
	Elec. (kW peak)				
	Oil (L/yr.)				
Cost Parameters	Upgrade, Material ($)	$31.28	$31.28	$31.28	OPA Quasi Prescriptive Measures and Assumptions, Page 100
	Upgrade, Installation ($)	$17.25	$17.25	$17.25	Estimated Installation Cost
	Baseline, Material ($)				Evaluated at full cost
	Baseline, Installation ($)				
	Total Measure Cost ($)	$48.53	$48.53	$48.53	
	Basis (Full/Incr.)	Full	Full	Full	
Incremental O&M ($/yr.)		$0	$0	$0	
Lifetimes	Upgrade (yrs.)	16.00	16.00	16.00	16 years BC Hydro QA Standard
	Baseline (yrs.)	16.00	16.00	16.00	16 years BC Hydro QA Standard
Cost Savings ($/yr.)		$ 7.54	$ 12.97	$ 16.22	
Simple Payback (yrs.)		6.4	3.7	3.0	
NPV of O&M Costs ($)		$0	$0	$0	
Total Benefits ($)	Electric Energy	223.36	384.32	480.65	
	Electric Demand	0.00	0.00	0.00	
	Natural Gas	0.00	0.00	0.00	
	Oil	0.00	0.00	0.00	
	Water	0.00	0.00	0.00	
Measure TRC ($)		174.83	335.79	432.12	
Benefit/Cost Ratio		4.60	7.92	9.90	
Cost of Conserved Electricity (CCE) (¢/kWh)		8.00	4.65	3.72	

Savings over Baseline	**Raw**	28.4%	28.4%	28.4%
	w/ Elec.Htg. Penalty	28.4%	28.4%	28.4%

Appendix F Background-Section 8: Economic Potential - Electric Energy Forecast

Introduction

Exhibit F 1 provides the detailed Economic Potential results for the hydro grid.

Exhibit F 1-1 Total Economic Potential Electricity Savings by End Use, Sub Sector and Milestone Year (MWh/yr.) – Hydro Grid

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Office																		
2015	3,420	1,306	-	423	3,367	187	895	316	1,428	55	-	16	-	-	-	-	-	11,415
2020	3,633	1,431	-	476	4,491	299	1,151	384	1,671	65	-	36	-	-	-	-	-	13,637
2025	3,880	1,572	-	536	5,730	424	1,440	460	1,957	76	-	41	-	-	-	-	-	16,116
2030	4,272	1,731	-	603	7,101	563	1,767	546	2,294	89	-	46	-	-	-	-	-	19,012
Food Retail																		
2015	335	386	397	179	332	12	164	73	78	-	6	2,468	-	-	-	-	-	4,429
2020	355	429	470	198	491	19	216	91	92	-	13	3,586	-	-	-	-	-	5,959
2025	379	477	553	219	667	27	275	111	108	-	14	4,763	-	-	-	-	-	7,593
2030	418	532	647	243	863	35	341	133	126	-	16	5,527	-	-	-	-	-	8,882
Non-food Retail																		
2015	2,611	1,599	376	600	1,298	54	462	118	203	-	-	40	-	-	-	-	-	7,362
2020	2,738	1,724	450	708	1,942	88	626	152	239	-	-	91	-	-	-	-	-	8,758
2025	2,889	1,865	534	831	2,656	126	811	191	280	-	-	103	-	-	-	-	-	10,287
2030	3,149	2,025	630	970	3,450	169	1,021	235	329	-	-	116	-	-	-	-	-	12,095
Hotel / Motel																		
2015	455	946	-	191	1,215	40	298	676	126	9	-	54	-	-	-	-	-	4,010
2020	479	1,035	-	215	1,728	62	376	1,017	146	10	-	122	-	-	-	-	-	5,191
2025	508	1,135	-	241	2,294	87	465	1,401	170	12	-	137	-	-	-	-	-	6,451
2030	556	1,248	-	271	2,922	114	565	1,835	198	14	-	155	-	-	-	-	-	7,876
Healthcare																		
2015	636	274	-	128	481	13	415	75	99	10	5	9	-	-	-	-	-	2,145
2020	677	292	-	143	735	19	540	110	115	12	11	20	-	-	-	-	-	2,674
2025	725	312	-	159	1,018	27	680	150	134	14	12	23	-	-	-	-	-	3,254
2030	797	335	-	177	1,334	35	837	194	156	16	14	26	-	-	-	-	-	3,921

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Education																		
2015	1,974	902	224	273	2,264	14	513	754	408	25	21	48	-	-	-	-	-	7,419
2020	2,130	963	276	310	3,426	21	661	897	482	29	47	103	-	-	-	-	-	9,345
2025	2,315	1,032	334	351	4,739	29	830	1,059	570	35	54	112	-	-	-	-	-	11,459
2030	2,582	1,110	399	399	6,224	39	1,022	1,245	675	41	62	121	-	-	-	-	-	13,918
Recreation Centres																		
2015	263	162	703	382	151	0	84	118	12	-	-	1,567	-	-	-	-	-	3,443
2020	269	170	813	424	273	1	103	165	14	-	-	1,729	-	-	-	-	-	3,962
2025	276	180	937	470	408	1	124	218	17	-	-	1,907	-	-	-	-	-	4,537
2030	292	190	1,074	521	558	1	147	277	19	-	-	2,105	-	-	-	-	-	5,185
Restaurant																		
2015	224	1,013	-	388	620	17	182	334	43	-	38	669	-	-	-	-	-	3,529
2020	254	1,103	-	431	831	28	245	516	51	-	87	1,043	-	-	-	-	-	4,590
2025	289	1,206	-	482	1,063	42	317	725	61	-	100	1,407	-	-	-	-	-	5,692
2030	332	1,324	-	540	1,321	57	400	965	73	-	115	1,690	-	-	-	-	-	6,818
Warehouse / Wholesale																		
2015	468	448	2,421	447	1,050	1	224	112	272	17	-	3	-	-	-	-	-	5,464
2020	492	491	2,897	504	1,744	2	278	159	319	20	-	6	-	-	-	-	-	6,912
2025	521	540	3,435	568	2,521	3	339	211	374	23	-	7	-	-	-	-	-	8,543
2030	569	596	4,044	640	3,394	4	409	271	439	27	-	8	-	-	-	-	-	10,402
Other General Service																		
2015	3,650	1,686	273	664	2,110	37	658	230	852	-	11	36	-	-	-	-	-	10,207
2020	3,779	1,821	324	757	3,005	37	876	281	986	-	24	81	-	-	-	-	-	11,971
2025	3,939	1,972	377	861	3,990	36	1,120	339	1,143	-	27	90	-	-	-	-	-	13,894
2030	4,242	2,140	437	977	5,075	36	1,393	404	1,325	-	30	101	-	-	-	-	-	16,160

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Non-Buildings																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Street lighting																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,016	-	2,016
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,113	-	2,113
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,304	-	2,304
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,620	-	2,620
Parking Lot Plug																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	88	88
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92	92
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	101	101
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	114	114
Grand Total																		
2015	14,036	8,722	4,394	3,676	12,889	375	3,896	2,806	3,522	116	80	4,910	-	-	-	2,016	88	61,526
2020	14,808	9,459	5,230	4,165	18,665	577	5,073	3,772	4,114	136	182	6,817	-	-	-	2,113	92	75,204
2025	15,721	10,291	6,170	4,718	25,087	802	6,401	4,866	4,813	159	208	8,589	-	-	-	2,304	101	90,229
2030	17,209	11,233	7,231	5,342	32,242	1,053	7,903	6,106	5,633	187	237	9,894	-	-	-	2,620	114	107,004

Appendix G Background-Section 9: Technology Assessment - Peak Load Measures

Introduction

Appendix G provides additional detailed information related to peak load reduction measures. The appendix discusses the following:

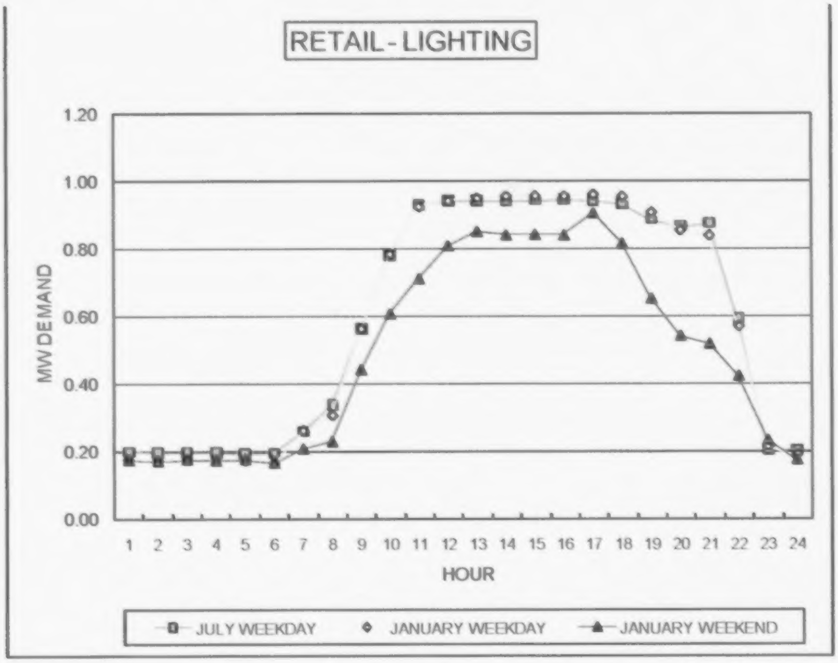
- Overview
- Description of electric peak reduction measures
- Measure lifecycle costing worksheets.

G1 Overview

Electric peak load measures are typically implemented by utilities to avoid or defer the costs of capacity expansion. Capacity costs refer to all levels of capital-based investments, including generating stations (new and upgraded), transmission and distribution lines, along with substations, transformers and other infrastructure required to deliver power, primarily related to peak capacity driven requirements.

Exhibit G 1 illustrates the base case Non-food Retail general lighting load profile on a cold December day (base case 4,647 MWH from Exhibit 10 in the body of the report). As shown, the daytime aggregate annual peak for these customers is estimated at about 0.93 MW, with about 0.95 MW for Peak Period 1 (6 pm) for this sub sector, and 0.90 MW for Peak Period 2 (4-8 pm).

Exhibit G 1 Baseline Commercial Non-Food Retail Lighting



Supply capacity can be purchased, but infrastructure must still be available to deliver the supply to customers. DSM measures that reduce peak requirements avoid and/or defer these capital-intensive investments.

From the customer's side, adoption of electric peak reduction strategies is typically dependent on the overall benefits to them, including direct incentive payments or rate benefits. Under most current rates for all but the smallest commercial customers, customers are billed both for peak demand (kW) and also for electric energy (kWh). Consequently, electric peak load measures that do not also reduce overall energy consumption do provide some financial benefits to customers if they coincide with their billing peaks. The industry trend is towards more specific pricing, including time-of-use and even hourly pricing, or peak incentives that pass along some of the utility benefits to customers on a performance basis. These new pricing structures provide incentive for commercial customers to implement measures or to participate in utility peak load reduction programs, as long as the differential between peak and off-peak prices are sufficient to provide a noticeable bill saving potential. These options are only limited by the availability and cost of suitable metering technology, remote facility data communications and by energy measurement storage options that would enable remote and/or automated measurement and control of devices.

G2 Description of Electric Peak Reduction Measures

The following sub sections provide a description of each of the measures listed in Section 9 of the main report. The discussion is organized by major end use and is presented in the following sub sections:

- Water heating
- Block heater timers and storage
- Lighting
- Whole facility misc. equipment
- Thermal energy storage for room and supplemental heating.

The discussion of each measure is organized as follows.

- Description
- Assumptions on applicability (dwelling type, unit types, vintage)
- Typical costs – one-time incremental, operating costs
- Typical electric peak reductions
- Other benefits
- Useful life
- Barriers and constraints for Economic and Achievable implementation
- Program issues.

Water Heating

Switch-based Water Heating Unit Load Control
Assumptions used for Analysis

Applicable facility type(s)	▪ Small-Medium Commercial Buildings – all with individual unit control/circuits
Applicable equipment type	▪ Water heater with at least a 40-gallon tank.
Vintage	▪ Existing and new
Costs	▪ $200 incremental cost in existing and new homes; $125 incremental cost as a add on to existing control system ▪ Approximately $10/site/year maintenance/evaluation
Electric peak reduction	▪ 80% reduction in water heating end use evening peaks ▪ About 80% of non-standby water heating energy reduction during curtailment is recovered
Useful life	▪ 10 years

Description

Switch-based water heating load control is accomplished by the installation of a remote control switch on either the water heater itself or on the circuits controlling the water heater. In older systems, this type of control has been accomplished via radio frequency (RF) control, which allows remote shut off of the water heater under specific capacity-constrained conditions during a limited number of pre-specified hours during winter peak months. In the systems that are currently offered, pager-based communications is used. An even more economic solution is to "piggyback" on an existing communications system. For example, if space heat control already exists, water heat control can be added via a hard-wired or wireless connection. This can significantly reduce the total cost of the water heat control.

Depending upon the length of the control, when the control is operated, and the size of the water heater tank, units can be shut off for the entire control period or cycled to limit their on time to a predetermined number of minutes per control cycle. Water heat control is commercially available and implemented in hundreds of thousands of sites in the U.S., thus demonstrating the viability of the technology, success of the programs, customer acceptance and utility satisfaction.

Applicability

Applicable dwelling types are any commercial buildings with an electric water heater that has at least a 40-gallon tank. The size of the tank is important because it provides hot water during times when the control is in effect. The larger the water heater tank, the longer the control can be in place without disrupting the customer's requirements.

Costs

Switches cost about $100 per unit, plus $100 for installation, plus maintenance. Costs are reduced to $125 (i.e., $25 incremental installation) if the control switch can be added to an existing control system at the same time, including any remote system, which may include thermostat control, engine block heater control, lighting or other. There are no savings in installation costs for a new facility.

Electric Peak Reduction

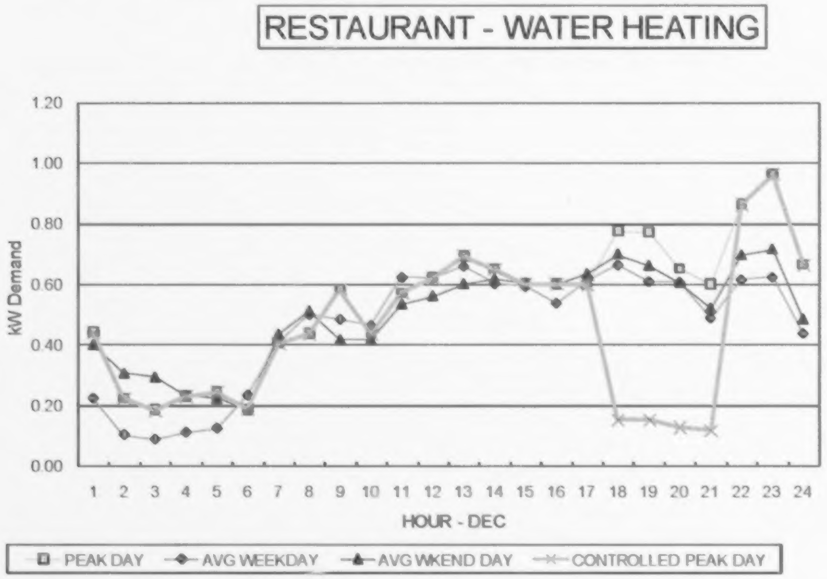
Assuming systems comparable to residential and primarily used for kitchen, washing and laundry usage, and annual energy consumption per participant (with 100% electric fuel use) of 4,000 kWh, the table below provides estimated impacts, assuming 80% reduction in load (i.e., 20% overrides, communications and switch failures):

Exhibit G 2 Commercial Sub Sector Load Shape Impact (kW)

Sub sector	Load Shape Code	Winter Peak Hour 18 (Peak period 1) impact	Winter Peak eve 4-8 pm (Peak Period 2) Impact	Winter Weekday morning 7-9 am (Peak Period 3) impact
Restaurant	2033	0.62	0.58	0.39
Hotel/Motel and Healthcare	2034	0.57	0.53	0.40
Retail	2035	0.24	0.39	0.15
Commercial All Other	2037	0.57	0.53	0.40

For the selected sub sectors and building size indicated, the range of Peak Period 2 impacts for this measure is 0.50 kW to 0.57 kW, assuming +/- 5% reduction percentage (from 20% average). Education is excluded because there is no significant water heater load expected during Peak Periods 1 or 2. Exhibit G 3 below illustrates an 80% reduction for Restaurant peak day water heating, compared to peak, weekday and weekend day load profiles.

Exhibit G 3 Commercial Water Heater Baseline vs. Controlled Load



Other Benefits

The water heater control switch would not provide customers with any ancillary benefits and thus the only incentive for participation would be monetary in nature, likely on a per annum or per control event basis.

Useful Life

This technology has a long history, going back at least 30 years on various types of equipment, including central air conditioners, water heaters and pool pumps. For the costing analysis, a 10-year life has been assumed, although there are programs which have had switches in place for longer.

Cost-Effectiveness Summary

Based on a one-time cost of approximately $200, ongoing maintenance of 5% (about $10/yr.) and estimated annual impacts of 0.50 kW – 0.57 kW, a preliminary estimate of the CEPR is $48 - $55 per kW. As an incremental option to other load control options within facilities, the installation costs would be reduced by $75 and the resulting CEPR would be $35 - $40 per kW.

Barriers and Constraints

Contractors are often the cause for lack of participation or dropouts, since they may incorrectly blame the switches for system performance problems, dissuading participation or resulting in removals. New tenants or their contractors may not know what the switches are and have them removed. With one-way communications, there is no way to verify whether the switch is even in place and an accurate count of actual switches in place cannot be reliably made without a systematic site verification plan.

Program Issues

Because there are no customer benefits inherent in the technology, a cash incentive would typically be expected for each season that the measure was needed, payable either by season or by event (or both). Additional work would be required to maintain, verify and evaluate the system performance to the same degree of accuracy as two-way systems due to the lack of confirmation and higher incidence of removals and failures.

Block Heater Timers and Storage

Engine Block Heater Load Control
Assumptions used for Analysis

Applicable facility type(s)	▪ For commercial fleets and maintenance vehicles often plugged in at the end of the work day
Applicable equipment type	▪ Block heaters and warmers
Vintage	▪ Existing and new
Costs	▪ $25 cost per vehicle for fleets of 10 or more ▪ $10 installation cost per vehicle ▪ Approximately $5/site/year maintenance/evaluation
Electric peak reduction	▪ 95% reduction in evening peaks ▪ 100% of energy reduction during curtailment is recovered
Useful life	▪ 10 years

Description

Engine block heater timers and/or control are accomplished by the installation of a timer that could be monitored and/or controlled by the utility to ensure that it is not overridden. The critical component in this application is to defer any operation until after the 5-8 pm peak period, especially in December, but including weekends as well. While timers can be used to reduce unnecessary energy consumption, reducing the heat cycle from 8-12 hours per day to the two to three hours per day that is required to ensure that engines are at warm enough temperatures to start, the timing of the operation is particularly key to the capacity control aspect. Ideally, operation should be both deferred until after 8 pm and staggered to prevent a local distribution peak (if the fleet operation was sizable enough), as well as billing demands for the fleet facility account, likely a separate parking garage or lot, to relieve the overall system peak associated with the 5-8 pm period.

Applicability

Applicable facility types are any business operation with a fleet of vehicles, such as post offices, taxis and utilities (electric, gas, cable, delivery services, taxi, hotel shuttle, etc.) where plug-in heaters are required for the vehicle fleet.

Costs

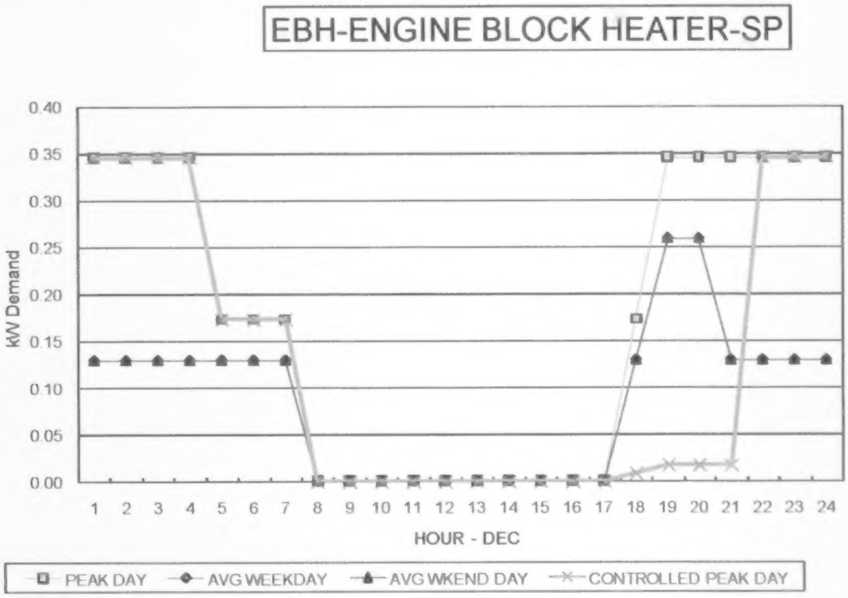
Given that a fleet operation is involved, economies of scale can be applied to reduce the costs of switch installation. Assuming at least 10 vehicles are involved, switches are assumed to cost about $25 per unit, plus $10 for installation, plus maintenance. There is no assumed incremental option.

Electric Peak Reduction

As with residential applications, assuming annual energy consumption per participant of 258 kWh, which would likely have been included in the outdoor lighting end-use category, baseline electric peak period loads are estimated as 0.173 kW for Peak Period 1 (system peak hour 6 pm), and 0.216 kW for Peak Period 2 (winter peak weekday 4-8 pm). Assuming 100% load control for evening peak hours, Exhibit G 4 below illustrates the baseline vs. control load profiles on the system peak day. This results in an estimated average of 0.173 kW per unit peak reduction for Peak Period 1 (at 6 pm) and an average of 0.216 kW per unit peak reduction for Peak Period 2 (4-8 pm), assuming no overrides or switch failures. These estimates may erode over time due to a number of factors, disabling of switches (by customers and contractors) and malfunctioning timers, so some maintenance and ongoing monitoring should be expected.

In Exhibit G 4 below, the red line represents the timer control option (controlled peak day) while the green line (peak day) represents the baseline. None of these load profiles assume use of timers used solely to reduce energy, which would not necessarily reduce evening peak demand unless specifically programmed to do so. The degree to which timers are set to defer usage and also lock out operation during 4-8 pm would be considered duplicated savings.

Exhibit G 4 Commercial Fleet Block Heater Baseline vs. Controlled Load



Other Benefits

The timers would also provide energy savings and, depending on the applicable rate in effect, could be operated to maximize bill savings as well.

Useful Life

Timers are an established technology. For the costing analysis, a 10-year life has been assumed, although timers can be expected to last longer than that if maintained in clean working condition, which would presumably be more feasible in a fleet facility environment.

Cost-Effectiveness Summary

Based on a one-time cost of approximately $25, ongoing maintenance of 10% (about $5/yr.) and estimated annual impacts of 0.173 kW – 0.216 kW per switch, a preliminary estimate of the CEPR is $33 - $42 per kW when applied to fleet facilities.

Barriers and Constraints

In a fleet operation, it is unlikely that contractors or operators would disconnect timers. Some switches may not maintain the correct time without some type of battery backup.

Program Issues

Without time-of-use rates, customers have no particular incentive to maintain the lock-out feature or timer operation to exclude the 4-8 pm period, so some monitoring may be necessary to ensure that block heater operation avoids system peaks. Additional monitoring and sampling would be required to maintain, verify and evaluate the system performance, which would be facilitated if the applicable facility were separately metered.

Lighting Load Control

Switch-based Lighting Load Control
Assumptions used for Analysis

Applicable facility type(s)	▪ All building types
Applicable equipment type	▪ Non-essential lighting
Vintage	▪ Existing and new
Costs	▪ $50 incremental cost in existing and new facilities; approximately $5/site/yr. maintenance/evaluation
Electric peak reduction	▪ 100% of non-essential lighting, assumed as 10% of baseline lighting usage, or 0.234 kW. ▪ No recovery energy is assumed
Useful life	▪ 8 years

Description

General and architectural lighting represent approximately 27% of Base Year (2010) energy consumption in Commercial sector buildings. In virtually every building and facility, there are expected to be a number of non-essential lighting loads that could be controlled for limited periods, such as during system peak critical hours.

Switch-based lighting load control is accomplished by the installation of a remote control switch on non-essential lighting circuits, wall switches and plug-in lamps or decorative lighting. Existing automation systems currently utilize plug-in modules with communication via power line carrier or short-run radio signals. These systems can also interface with PCs and through telephone interfaces so that remote control can be accomplished as well. In terms of technical capability, the improvements to these existing systems that will facilitate their use in utility electric peak load control would require some reduced cost and more standardized and reliable remote interfaces.

Typical commercial EMS systems have some capability for remote programming for on-demand control use, but this capability may need to be enhanced. Most likely, this would be achieved as part of an add-on wireless communications control switch linked to the outside through a remote load control system already in place to maximize or even enable cost effectiveness. What is required is a gateway via broadband (e.g., broadband over power lines) or through the meter that would accept outside signals (such as from the utility) and convert them to short-run wireless (or wired) signals that would trigger switches placed on selected lights and appliances. This section describes the lighting applications only, in order to determine effect on lighting load profiles. The next section addresses aspects of non-lighting loads, although lighting and non-lighting plug loads are not expected to require separate systems, but rather a single gateway that controls switches for any plug load or, for lighting, wall switch. This technology would be applicable for any commercial facility, which could make effective use of total building communications through building wiring or a building wi-fi system, as is common for electrical sub metering applications today.

Applicability

This measure is applicable to all building and business types, but would be most applicable to Offices, Non-food Retail, Hotel/Motel, Education and Warehouses, and especially where occupancy varies and occupancy sensors are not viable.

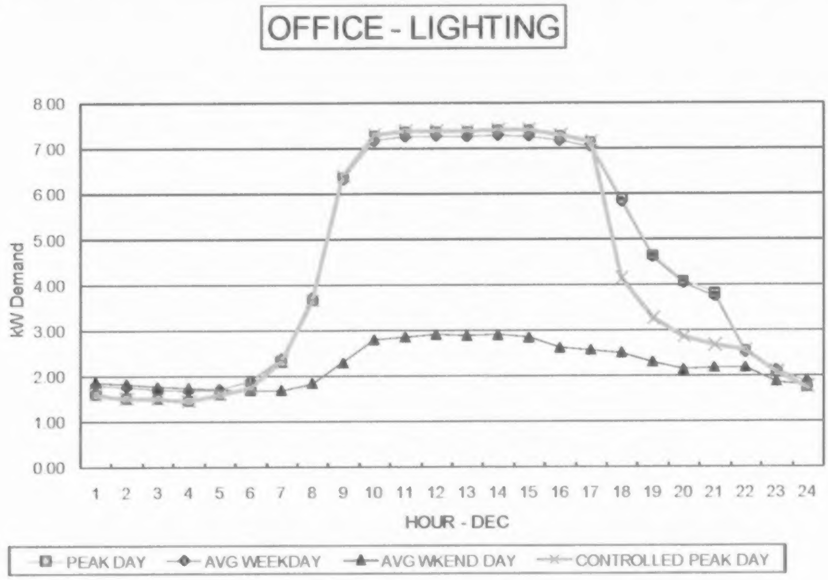
Costs

Gateway systems are estimated at \$100 - \$300 per site installed, although they would be expected to serve multiple purposes. For example, a programmable communicating thermostat or electric meter already installed in a commercial building for other applications could include a relay board that would relay signals from a remote host over broadband, building wiring or via wi-fi to individual devices in commercial spaces from one or more distinct customers within a single building. Switches are assumed to cost about \$10 per unit (assume 10 for this example), which could control multiple lights and plug loads, and \$100 installation. There is no savings assumed for installation costs for a new building.

Electric Peak Reduction

Based on annual general and architectural lighting loads per facility, using an Office suite of 5,000 square feet as an example, estimated base lighting consumption would be approximately 33,000 kWh (assuming 6.6 kWh/ft^2). Based on this, and using the general lighting load shape and assuming 30% of the average lighting load is controllable during the 4-8 pm Peak Period 2, impacts would be approximately 1.60 – 1.77 kW/site. In the figure below, the red line represents the timer control option (controlled peak day) while the green line (peak day) represents the baseline, assuming 30% lighting reduction from 4-8 pm.

Exhibit G 5 Commercial Office Lighting Baseline vs. 30% Controlled Load



Other Benefits

The gateway systems and switches would provide customers with many ancillary benefits, such as remote shut off of lights and appliances for security, convenience and energy saving, although no energy savings has been assumed for this analysis.

Useful Life

This technology has a fairly long history, going back at least 20 years for various protocols of home automation devices, including X-10 protocol units, which have been available through electronics stores under various brand names. For the costing analysis, an eight-year life has been assumed, although the units typically last 10-15 years.

Cost-Effectiveness Summary

Based on the inclusion of a modest ($100) gateway system installation and 10 switches (at $10 each), installation cost of approximately $100, ongoing maintenance/support of 10% (about $10/yr,) and estimated annual impacts of 1.60 – 1.77 kW, the estimated CEPR is $26 - $28 per kW/yr. when applied to an Office. Business types with more coincident lighting during 4-8 pm, such as Retail, Healthcare and Hotel/Motel would be better options. For practical and economic purposes, this type of system may be incremental to an existing EMS or other facility control system, which would reduce the installation cost further.

Barriers and Constraints

The technology for this application, while existing, is not quite ready for general use and would be greatly enhanced by the introduction of gateways that are only now being pilot tested. In addition, without some type of time-based rate, there would be little incentive for customers to purchase these devices, even as timers, without cash incentives.

Program Issues

In the short term, the utility could work with building owners, building managers, electronics distributors and ESCOs to pilot test and demonstrate the benefits of these types of systems for remote shutdown of lights during the defined peak periods on system-critical days. This would be facilitated by adoption of time-of-use rates that would be consistent with the peak periods, with critical peak pricing periods on a handful of system peak days providing the additional incentive for customers to utilize their systems during system peak critical periods. Typical switches can be overridden easily so programming them as a default to shut certain lights for the peak winter months with the option to turn them back on if needed would be feasible.

Multiple (Miscellaneous Plug Loads)

See the discussion on lighting for description, applicability and costs, which are the same.

Electric Peak Reduction

Assuming a typical medium commercial Office suite of 5,000 ft^2, assume average computer and plug loads would be about 20,000 kWh/yr. at 3.96 kWh/ ft^2/yr. for miscellaneous plug loads. This would translate to about 3.23 kW of system-coincident computer and plug loads (under the Peak Period 2 definition). There are numerous devices to which this measure could be applied, including phantom loads; principal among these would be copiers, printers, monitors and electronic device chargers (many of which could be ganged on one power strip with a single switch). For the purposes of this analysis, it is assumed that 717 - 920 watts of devices could be controlled by five switches controlling “smart” power strips. Some equipment may have built-in features that place them in standby or sleep mode but this has not been assumed. This would consist of either standby (or sleep mode) power on units not being used, or full active standby power on units considered temporarily non-essential, as designated through cooperative agreement among utility, building management and occupants. The table below lists the best candidates, based on a 1999 standby study by LBNL,[8] as well as other sources and project team experience.

Exhibit G 6 Commercial Office Appliance Power Consumption Ranges (W)

Appliance	Range of Power Consumption (Watts)
Small office copier	20 (standby) - 250 W
Ink jet printer	4 – 6 W
Laser printer	20 – 40 W
Hot/cold water cooler	70 W
LCD monitor	10 – 28 W
CRT monitor	50 -150 W
Instant/one-cup coffee-makers	30 – 50 W
Set-top boxes	5 – 25 W
Large screen TVs/monitors	5 – 22 W

For example, in offices with two or more copiers, at least one could be designated as interruptible, and either turned off or placed in sleep mode (standby) during utility system-critical days, reducing electric load by the active standby power level or active standby less standby. Initially, this function could be done through O&M measures, but ultimately are assumed to be implemented by remote utility control, either directly or through building management, as well as integrated into energy management systems (EMS). Copiers, laser printers, one-cup coffee makers and hot/cold water coolers would be ideal for these applications since they have heating elements that consume significant power and can be shut down for several hours without significant effect on business operations.

Cost-Effectiveness Summary

Based on the 100% incremental scenario, five switches ($50) and $20 for incremental installation costs, $10/yr. for maintenance, and estimated annual impacts of 200 watts on demand, encompassing a mix of the above devices being controlled, the estimated CEPR is $17 - $23 per kW/yr. vs. stand alone ($100 gateway) of $30 - $41 per kW/yr. For practical purposes, this type of system would not be used in stand-alone cases, only as an increment to an existing gateway system with lighting switches already in place.

Multiple Facility – Remote Circuit Control

Switch-based Interruptible Circuit Load Control
Assumptions used for Analysis

Applicable facility type(s)	▪ Office, Hotel/Motel building elevators ▪ Retail, Food, Hotel, Restaurant and Education refrigeration
Applicable equipment type	▪ Elevators, selected refrigeration/lighting units, HVAC systems and pumps
Vintage	▪ Existing and new
Costs	▪ $200 incremental cost in existing and new buildings; $100 incremental cost as a add on to an existing control system ▪ Approximately $20/site/yr. maintenance/evaluation
Electric peak reduction	▪ Assume 75% reduction in baseline loads of circuits for selected elevator and refrigeration/lighting equipment, 50% for HVAC systems and pumps; minimal recovery energy
Useful life	▪ 10 years

---

[8] Standby Power. http:/standby.lbl.gov – Lawrence Berkeley National Labs.

Description

Switch-based load controls on interruptible equipment is accomplished by the installation of remote control switches on selected equipment that is redundant (e.g., multiple elevator banks) or considered temporarily non-essential (e.g., refrigeration and lighting on beverage cases where spoilage is not an issue, HVAC systems and pumps in large facilities). In older systems, this type of control has been accomplished via radio frequency (RF) or power line carrier ("PLC" – through building wiring) control, which allows remote shut off of circuits under specific capacity-constrained conditions during a limited number of pre-specified hours during winter peak months. In newer systems and those projected for the future, other communications systems are expected, including wireless and wi-fi. An even more economic solution is to "piggyback" on an existing communications system or EMS. Most controlled loads anticipated under this measure would be capable of 100% shutdown for the several hours of critical peak periods. Units could also be cycled to limit their on time to a predetermined number of minutes per control cycle, but this may not be feasible for control of large circuits. In elevators, linking into local lock-out circuitry may be feasible, which would eliminate the need (and cost) of installing switches on circuits. For HVAC systems and pumps, existing EMS or demand-control systems could be accessed.

Applicability

Applicable facility types are any commercial buildings with types of loads that can be shut down for several hours without adverse effects on business operations or customer service. For example, elevators in multiple elevator buildings, refrigeration in empty cases or lighting in selected refrigeration cases, and HVAC fans and pumps could all be controlled. This would have some limits since Peak Period 2 (4-8 pm) generally corresponds to times when they may be in active use for some facility types (e.g., elevators in offices, refrigerator cases for grocery stores or restaurants). Another example is beverage cases for soft drinks or alcohol in grocery stores or supermarkets that would be minimally affected by being shut off for several hours.

Costs

Control system costs are assumed to be $200 for new installations. Switch costs are assumed at about $50 per unit, plus $100 for installation, plus $50/yr. maintenance. Costs are reduced to $150 (i.e., $150 incremental installation) if the control switch can be added to an existing control system at the same time. There is no savings in installation costs for a new facility.

Electric Peak Reduction

Elevator loads are approximately 2% of medium-large Office buildings, where this option is most applicable. For a typical large Office building it is assumed that Peak Period 2 demand would be approximately 15 kW. Assuming 25% of elevator consumption would be deferrable (shut down one of four elevators), that would result in 3.75 kW load reduction potential.

HVAC system fans and pumps comprise approximately 10% of commercial energy consumption. This option would be considered applicable only in larger facilities where there is central control and would exclude the Restaurant sub sector. We have assumed an average of about 3 kW per circuit. Assuming that 50% of HVAC system fans and pumps would be deferrable through use of alternate shutdowns and cycling, the result would be an estimated 1.5 kW per unit of peak reduction.

For refrigeration units (with lighting), this would apply primarily to Food Retail applications, including cafeterias in the Education, Hotel/Motel and Restaurant sub sectors. Refrigeration for a 5,000-ft^2 food store would contribute about 17.5 kW in the baseline scenario (3.5 kW per 1,000 ft^2). Control of 10% of that load would be 1.75 kW, which should be controllable with five switches (350 watts/switch).

Other Benefits

None.

Useful Life

Control switch technology has a long history. For the costing analysis, an eight-year life has been assumed.

Cost-Effectiveness Summary

For elevator controls and HVAC system fans and pumps, we have assumed a capital cost of $300, installation of $250, plus $100 for switches. Based on a stand-alone scenario and estimated electric peak load reduction totaling 5.25 kW for applicable building types (large Office buildings for elevators, most building types for fans and pumps), the estimated CEPR is $38 per kW/yr. for stand-alone systems. For elevators, most likely, this system would be used in stand-alone cases because of the difficulty in integrating it with other building systems. For HVAC system fans and pumps, while it is assumed that this would be a stand-alone system, it could also be integrated with other building systems. Removing the capital cost of a gateway, but leaving installation, switch and maintenance would reduce the CEPR to $31/kW/yr.

For refrigeration control, we have assumed stand-alone control system costs of $200 for devices, $100 for installation and $125 for five switches in a 5,000-ft^2 facility, with $50 annual maintenance, all over eight-year equipment life. This would result in an estimated CEPR of $53 per kW/yr. For an incremental installation (no capital equipment), this would reduce the CEPR to $39 per kW/yr.

Barriers and Constraints

The technology for this application is already utilized in limited applications, but would be greatly enhanced by the introduction of gateways, which are only now being pilot tested, that would link outside utility control to internal building control systems. Financial incentives would provide a significant incentive for customers to invest in these systems themselves, in the absence of utility incentives for the initial investment or pay-for-performance incentives for peak demand response.

Program Issues

In the short term, the utility could work with building owners, building managers and customers with applicable interruptible refrigeration systems, including ESCOs, to pilot test and demonstrate the benefits of these types of systems for remote shutdown of elevator, HVAC fans, pumps and refrigeration units during the defined peak periods on system-critical days. This would be facilitated by adoption of time-of-use rates that would be consistent with the peak periods, with critical peak pricing periods on a handful of system peak days providing the additional incentive for customers to utilize their systems during system peak critical periods. Typical switches can be overridden.

In addition, the effect of current and potential incoming federal regulations for reduced standby power levels should be taken into account when estimating potential program impact.

Electric Thermal Storage (ETS) Room Units

Electric Thermal Storage (ETS) Room Units
Assumptions used for Analysis

Applicable facility type(s)	▪ Hotel/Motel, Restaurant and Office, where individual room unit control is feasible and can take advantage of variable occupancy – requires off-peak rate structure
Applicable equipment type	▪ Baseboard systems compatible with replacement by stand-alone room unit ETS systems
Vintage	▪ Existing and new
Costs	▪ Assuming 15-hour operation (nine hour overnight charge time): ▪ $1,200 - $1,600 for room ETS units, vs. $400 for standard room baseboard system ▪ Assume $200 incremental installation costs; approximately $100/site/yr. incremental maintenance
Electric peak reduction	▪ Assume 95% of current full electric loads (assuming 5% override), operating 100% off peak otherwise, with only residual fan (same as baseline) during 15 daytime hours. Estimated 0.73 kW peak reduction for 2,500 annual kWh ▪ Approximately 5% increase in space heating energy for losses
Useful life	▪ 15 years (comparable to heat pump)

Description

ETS is a technology that has been widely used in Europe and selectively used in North America for more than 40 years. The basic premise of the systems is to convert electricity into heat and store it in specially designed high-density ceramic bricks, capable of holding heat up to 1,650°C. Combined with a utility off-peak rate, operation in charging mode during low-cost off-peak hours can provide heat all day, if properly sized, by thermostat-controlled release of heat from the bricks through either forced air or hydronic systems. Units come in various sizes, from whole-house units to individual room units. Control systems to ensure proper heat distribution are typically included and systems can be retrofitted or installed in new construction applications. The principal manufacturer in North America is Steffes Corp.[9], and marketing is principally accomplished through electric co-ops, as well as many northern U.S. and Canadian utilities, including Nova Scotia Power and Hydro-Quebec, where a sufficient differential between peak and off-peak prices during winter months makes it economical for residents. Many winter-peaking generation, transmission and distribution co-ops market the units in order to minimize their capacity requirements during peak winter.

Applicability

With the various size units available, ETS can be installed in any room, as a replacement or as a supplement to electric baseboard systems. For the Hotel/Motel and Healthcare sub sectors, and some Offices where occupancy varies, ETS can be used to replace comparable electric baseboard units. Often, a separate meter is used to measure only the central heating systems to best take advantage of the off-peak rate but a separate meter would not be viable for room units. Systems would be configured to take advantage of rates, ideally a time-of-use rate, with charging periods designed to virtually eliminate any operation during peak periods. For Yukon, a 15-hour peak rate period (7 am – 10 pm) and nine-hour off-peak rate (10 pm – 7 am) would be used by the utility.

---

[9] http://www.steffes.com.

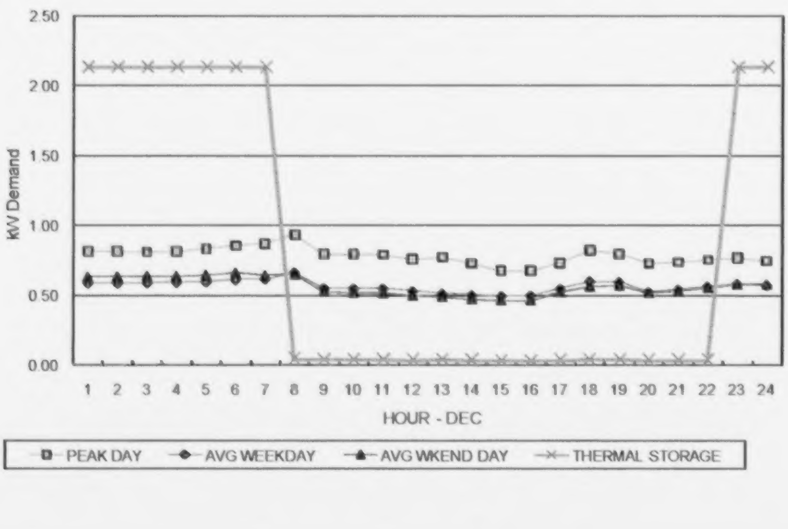
Costs

Initial costs for ETS systems are significantly higher than standard heating systems. For the economics to work for the customer, the rate differential must be significant, at least two or three to one for peak to off-peak. Initial costs are roughly proportional to the unit sizing, with an ETS system requiring two to three times the size of a standard system, and somewhat higher installation and maintenance costs. In addition, additional control equipment and sometimes wiring upgrades are necessary, as well as placement in the home (requires sufficient support for additional weight), making the specification of a system critical in terms of applicability. In general, larger facilities work best. For the purpose of this study, preliminary costs have been developed based on literature search and an interview with a representative of Steffes Corp.

Electric Peak Reduction

Electric peak load reduction would be theoretically 100% of the peak heating requirements of a standard electric space heater for the applicable room. Off-peak loads would be more than twice the levels so it would be critical to size the systems properly for the expected charging period. For example, for a large room with 3,000 annual kWh requirements for space heating, Peak Period 1 loads would be about 0.87 kW, and Peak Period 2 loads would average 0.77 kW. For the costing analysis, it is assumed that 5% of the usage would still be on peak to account for minimal overrides or where units do not provide all heating requirements through off-peak charging (even though theoretically designed to do so). For a room ETS unit, the comparable overnight (charging) on a peak day would be as illustrated below. Peak load reduction would therefore be about 0.82 kW at the hour ending 6 pm system Peak Period 1 and average 0.74 kW during the 4-8 pm peak period.

Exhibit G 7 Electric Thermal Storage Heating – Room Unit



Other Benefits

None.

Useful Life

This technology has a long history in Europe and the bricks are virtually indestructible, so the useful life is considered the same as comparable room heating systems, 15 years. Electronic control systems are required, which involve some maintenance.

Cost-Effectiveness Summary

For central systems, analysis is based on a one-time incremental cost of approximately $1,000 for the unit plus $150 installation, plus $50 annual maintenance. Estimated annual impacts of 0.73 – 0.76 kW were used, based on 95% of Peak Period 1 and 2 loads. Under those assumptions, a preliminary estimate of the CEPR is $132 - $147 per kW/yr.

Barriers and Constraints

The existence of an off-peak rate with significant differential is a major consideration, although additional metering and infrastructure (priced at $150 per site) would not be justified solely for this purpose. Numerous logistical and wiring issues would also need to be addressed. Space requirements and sufficient weight-bearing floors for installation of the units, which are much heavier than standard heating equipment, would be potential constraining factors to feasible installations.

Program Issues

While many co-ops and several major Canadian utilities have programs for this application, which could be consulted to assist in designing the program and identifying barriers experienced in real implementation (not just pilot programs), the programming infrastructure required would involve a significant commitment.

Electric Heat Switch Controls for Hotel/Motel

Electric Heat Switch Controls for Hotels
Assumptions used for Analysis

Applicable facility type(s)	▪ Hotel/Motel, where 10% of space heating is electric, where individual room control is feasible and can take advantage of variable occupancy
Applicable equipment type	▪ Electric room heating systems compatible with switch control
Vintage	▪ Existing and new
Costs	▪ $1,250 system cost with installation plus $50/switch for 10 room installation, plus $200 annual maintenance ▪ Assume $200 incremental installation costs, with all other costs the same
Electric peak reduction	▪ Assume 50% reduction in base loads, including overrides, estimated 6.2 – 6.4 kW reduction for 10 rooms for 5-9 pm period, approximately 5% increase in space heating energy for losses
Useful life	▪ 10 years (comparable to heat pump)

Description

Electric heating in the Hotel/Motel sub sector is subject to occupancy variables. Existing switch technology is available to enable remote central control of individual room units via thermostat or switch control. For rooms that are temporarily unoccupied (not reserved at all or the occupants are out of their rooms) during the 4-8 pm period, heating could be reduced significantly. It is estimated that 50% reduction could be achieved via temporary curtailment.

Applicability

Hotels or motels with at least 10 rooms would be expected to be large enough to accommodate the central control systems required.

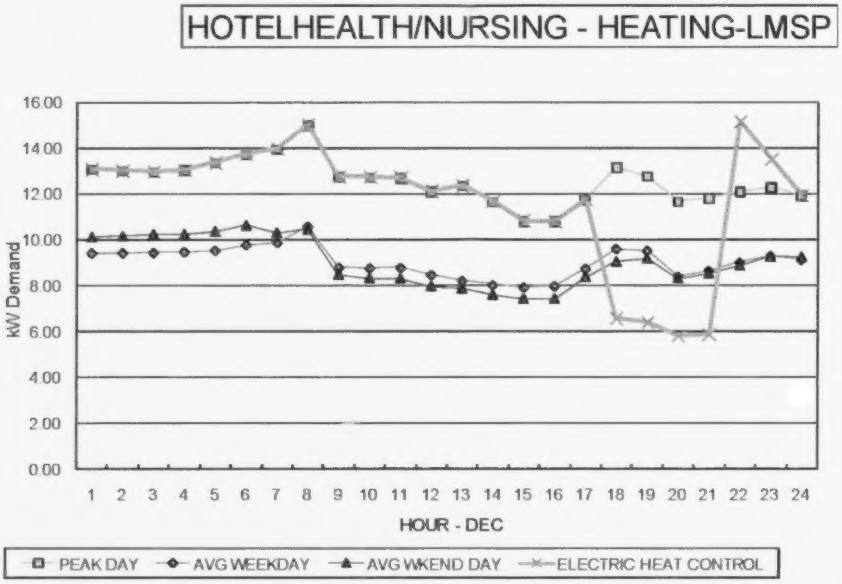
Costs

Initial costs for a central control system are estimated at $1,000 for a 10-room system, with $200 annual maintenance and $250 installation. Switches are estimated at $50 each, so a 10-switch system would cost $500.

Electric Peak Reduction

Electric peak load reduction would be theoretically 50% of the peak heating requirements of a standard electric space heater for the applicable room. Based on a 400-ft^2 room, 10 rooms and 10 kWh/ ft^2 annual heating requirement, total base annual consumption for 10 rooms would be 40,000 kWh. This translates to a 4-8 pm peak of about 10.31 kW and 11.55 kW at 6 pm for the 10 rooms. A 50% peak load reduction would therefore be about 5.2 – 5.8 kW, as illustrated below.

Exhibit G 8 Electric Heat Switch Controls for Hotel/Motel



Other Benefits

Hotels and motels could use this at other times to remotely reduce heating when rooms are unoccupied in order to save energy and also reduce their own billing peak.

Useful Life

Switches have a typical lifetime of 10 years, with maintenance.

Cost-Effectiveness Summary

Assuming systems costs as outlined above, a 10-room system would have a CEPR of $56 - $63 per kW/yr. An incremental system installation, assuming that there is already a system in place that would be capable of the type of control and could be retrofitted to the required curtailment scheduling, would have a CEPR of $42 - $47 per kW/yr.

Barriers and Constraints

Concerns about guest comfort would need to be addressed and some heating systems would not be compatible with the type of equipment and systems required. Some type of override (remotely by hotel manager or by guest) may need to be tuned to enable easy access.

Program Issues

None.

G3 Measure Lifecycle Costing Worksheets

The following worksheets detail the calculation of CEPR for each of the electric peak measures listed.

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Water Heating

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$100.00	Maintenance	$10.00
Installation	$100.00	Support	$0.00
Other	$0.00	Other	$0.00
Total	$200.00	Total	$10.00

3 **Net present Value Cost (1)**	$273.79	
	Low	High
4 **Peak Reduction (kw/yr)**	0.41	0.56
5 **Life-Cycle Peak reduction**	4.10	5.60
6 **Cost of Electric Peak Reduction (CEPR)** (Rounded to $)	**$67.00**	**$49.00**

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 10

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Water Heating (incremental)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$100.00	Maintenance	$10.00
Installation	$25.00	Support	$0.00
Other	$0.00	Other	$0.00
Total	$125.00	Total	$10.00

3 **Net present Value Cost (1)**	$198.79	
	Low	High
4 **Peak Reduction (kw/yr)**	0.41	0.56
5 **Life-Cycle Peak reduction**	4.10	5.60
6 **Cost of Electric Peak Reduction (CEPR)** (Rounded to $)	**$48.00**	**$35.00**

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 10

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Engine Block Heater

1 **One-time Costs - Retrofit**			2 **Recurring Costs ($/yr)**	
Capital/Device	$25.00		Maintenance	$5.00
Installation	$10.00		Support	$0.00
Other	$0.00		Other	$0.00
Total	$35.00		Total	$5.00
3 **Net present Value Cost (1)**	$71.89			
	Low	High		
4 **Peak Reduction (kw/yr)**	0.259	0.329		
5 **Life-Cycle Peak reduction**	2.59	3.29		
6 **Cost of Electric Peak Reduction (CEPR)**				
(Rounded to $)	**$28.00**	**$22.00**		

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 10

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Engine Block Heater (incremental)

1 **One-time Costs - Retrofit**			2 **Recurring Costs ($/yr)**	
Capital/Device	$25.00		Maintenance	$5.00
Installation	$10.00		Support	$0.00
Other	$0.00		Other	$0.00
Total	$35.00		Total	$5.00
3 **Net present Value Cost (1)**	$71.89			
	Low	High		
4 **Peak Reduction (kw/yr)**	0.259	0.329		
5 **Life-Cycle Peak reduction**	2.59	3.29		
6 **Cost of Electric Peak Reduction (CEPR)**				
(Rounded to $)	**$28.00**	**$22.00**		

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 10

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Lighting (stand-alone)

1 **One-time Costs - Retrofit**			2 **Recurring Costs ($/yr)**	
Capital/Device	$100.00		Maintenance	$5.00
Installation	$100.00		Support	$5.00
Switches (10)	$100.00		Other	$0.00
Total	$300.00		Total	$10.00
3 **Net present Value Cost (1)**	$362.97			
	Low	High		
4 **Peak Reduction (kw/yr)**	0.92	1.38		
5 **Life-Cycle Peak reduction**	7.36	11.04		
6 **Cost of Electric Peak Reduction (CEPR)**				
(Rounded to $)	**$49.00**	**$33.00**		

(1) Discount Rate/yr 7.5%

Device Lifetime (yrs) 8

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Plug Loads

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$100.00	Maintenance	$10.00
Installation	$20.00	Support	$0.00
Switches (5)	$50.00	Other	$0.00
Total	$170.00	Total	$10.00
3 **Net present Value Cost (1)**	$232.97		
	Low	High	
4 **Peak Reduction (kw/yr)**	0.300	0.300	
5 **Life-Cycle Peak reduction**	2.40	2.40	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$97.00**	**$97.00**	
(1) Discount Rate/yr	7.5%		
Device Lifetime (yrs)	8		

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Plug Loads (incremental)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$0.00	Maintenance	$10.00
Installation	$20.00	Support	$0.00
Switches (10)	$50.00	Other	$0.00
Total	$70.00	Total	$10.00
3 **Net present Value Cost (1)**	$132.97		
	Low	High	
4 **Peak Reduction (kw/yr)**	0.300	0.300	
5 **Life-Cycle Peak reduction**	2.40	2.40	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$55.00**	**$55.00**	
(1) Discount Rate/yr	7.5%		
Device Lifetime (yrs)	8		

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Elevators, HVAC Fans and Pumps (Stand-alone)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$300.00	Maintenance	$100.00
Installation	$250.00	Support	$50.00
Switches	$100.00	Other	$0.00
Total	$650.00	Total	$150.00

3 **Net present Value Cost (1)** $1,594.49

	Low	High
4 **Peak Reduction (kw/yr)**	5.250	5.250
5 **Life-Cycle Peak reduction**	42.00	42.00
6 **Cost of Electric Peak Reduction (CEPR)** (Rounded to $)	**$38.00**	**$38.00**

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 8

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Elevators, HVAC Fans and Pumps (incremental)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$0.00	Maintenance	$100.00
Installation	$250.00	Support	$50.00
Switches	$100.00	Other	$0.00
Total	$350.00	Total	$150.00

3 **Net present Value Cost (1)** $1,294.49

	Low	High
4 **Peak Reduction (kw/yr)**	5.250	5.250
5 **Life-Cycle Peak reduction**	42.00	42.00
6 **Cost of Electric Peak Reduction (CEPR)** (Rounded to $)	**$31.00**	**$31.00**

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 8

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Interruptible Loads - Refrigeration

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$200.00	Maintenance	$50.00
Installation	$100.00	Support	$0.00
Switches (5)	$125.00	Other	$0.00
Total	$425.00	Total	$50.00

3 **Net present Value Cost (1)** $739.83

	Low	High	
4 **Peak Reduction (kw/yr)**	1.750	1.750	(10% of peak for 5000 sf)
5 **Life-Cycle Peak reduction**	14.00	14.00	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$53.00**	**$53.00**	

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 8

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Commercial Interruptible Loads - Refrigeration (incremental)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$0.00	Maintenance	$50.00
Installation	$100.00	Support	$0.00
Switches (5)	$125.00	Other	$0.00
Total	$225.00	Total	$50.00

3 **Net present Value Cost (1)** $539.83

	Low	High	
4 **Peak Reduction (kw/yr)**	1.750	1.750	(10% of peak for 5000 sf)
5 **Life-Cycle Peak reduction**	14.00	14.00	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$39.00**	**$39.00**	

(1) Discount Rate/yr 7.5%
Device Lifetime (yrs) 8

LIFE-CYCLE COSTING WORKSHEET

Electric Thermal Storage - Room Unit Heating System - Commercial

1 **One-time Costs**		2 **Recurring Costs ($/yr)**	
Capital/Device	$1,000.00	Maintenance	$50.00
Installation	$150.00	Support	$0.00
Other (Meter)	$0.00	Other	$0.00
Total	$1,150.00	Total	$50.00

3 **Net present Value Cost (1)** $1,624

	Low	High	
4 **Peak Reduction (kw/yr)**	0.73	0.76	(95% of Peak period 2)
5 **Life-Cycle Peak reduction**	10.95	11.40	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$148**	**$142**	

---

(1) Discount Rate/yr 7.5%

Device Lifetime (yrs) 15

LIFE-CYCLE COSTING WORKSHEET

One-Way Switch - Hotel Electric Heating

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$1,000.00	Maintenance	$200.00
Installation	$250.00	Support	$0.00
Switches (10)	$500.00	Other	$0.00
Total	$1,750.00	Total	$200.00

3 **Net present Value Cost (1)**	$3,225.78		
	Low	High	
4 **Peak Reduction (kw/yr)**	6.20	6.40	10 rooms @50% Cycling
5 **Life-Cycle Peak reduction**	62.00	64.00	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$52.00**	**$50.00**	

(1) Discount Rate/yr	7.5%
Device Lifetime (yrs)	10

LIFE-CYCLE COSTING WORKSHEET

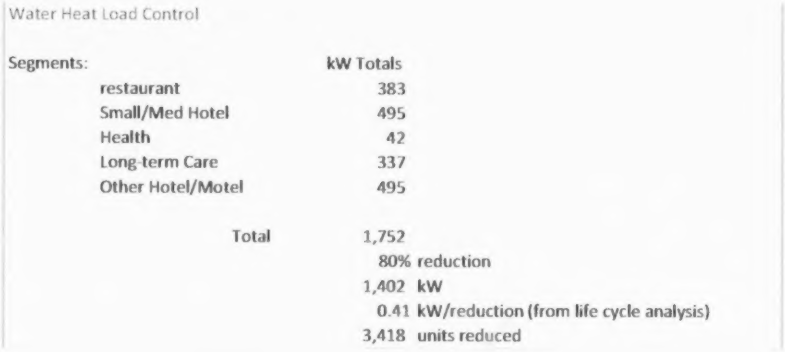
One-Way Switch - Hotel Electric Heating (incremental)

1 **One-time Costs - Retrofit**		2 **Recurring Costs ($/yr)**	
Capital/Device	$200.00	Maintenance	$200.00
Installation	$250.00	Support	$0.00
Switches (10)	$500.00	Other	$0.00
Total	$950.00	Total	$200.00

3 **Net present Value Cost (1)**	$2,425.78		
	Low	High	
4 **Peak Reduction (kw/yr)**	6.20	6.40	10 rooms @50% Cycling
5 **Life-Cycle Peak reduction**	62.00	64.00	
6 **Cost of Electric Peak Reduction (CEPR)**			
(Rounded to $)	**$39.00**	**$38.00**	

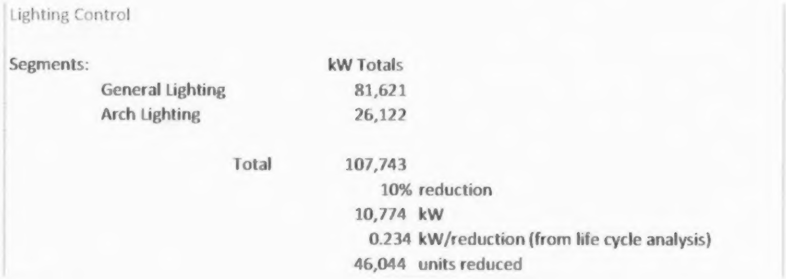
(1) Discount Rate/yr	7.5%
Device Lifetime (yrs)	10

The following worksheets calculate the counts by end use for per-unit cost calculations and supply curve development.



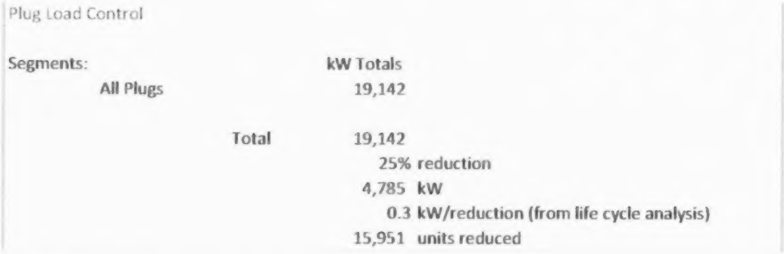
Water Heat Load Control

Segments:		kW Totals	
	restaurant	383	
	Small/Med Hotel	495	
	Health	42	
	Long-term Care	337	
	Other Hotel/Motel	495	
	Total	1,752	
		80%	reduction
		1,402	kW
		0.41	kW/reduction (from life cycle analysis)
		3,418	units reduced



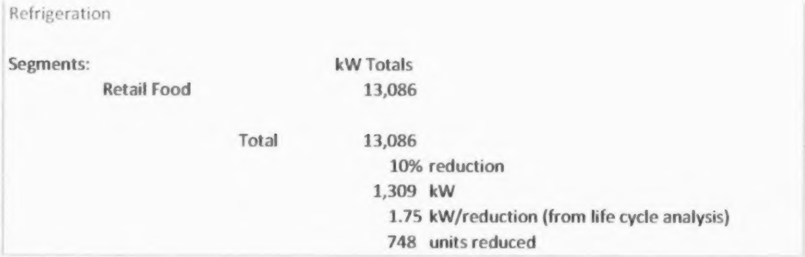
Lighting Control

Segments:		kW Totals	
	General Lighting	81,621	
	Arch Lighting	26,122	
	Total	107,743	
		10%	reduction
		10,774	kW
		0.234	kW/reduction (from life cycle analysis)
		46,044	units reduced



Plug Load Control

Segments:		kW Totals	
	All Plugs	19,142	
	Total	19,142	
		25%	reduction
		4,785	kW
		0.3	kW/reduction (from life cycle analysis)
		15,951	units reduced



Refrigeration

Segments:		kW Totals	
	Retail Food	13,086	
	Total	13,086	
		10%	reduction
		1,309	kW
		1.75	kW/reduction (from life cycle analysis)
		748	units reduced

HVAC Fans & Elevators

Segments:		kW Totals	
	Large Office Elevators	736	
	Large Office HVAC	12,016	
	Total	12,752	
		25%	reduction
		3,188	kW
		5.25	kW/reduction (from life cycle analysis)
		607	units reduced

Hotel Switch Control

Segments:		kW Totals	
	Large Hotel Space Heat	835	
	Other Hotel Sp Heat	1,073	
	Total	1,908	
		50%	reduction
		954	kW
		6.3	kW/reduction (from life cycle analysis)
		151	units reduced

Hotel & 10% Restaurant/Ofice Thermal Storage

Segments:			kW Totals	
	Large Hotel Space Heat		835	
	Other Hotel Sp Heat		1,073	
	Restaurant	10%	131	
	Other Office	10%	492	
	Total		2,531	
			95%	reduction
			2,404	kW
			0.745	kW/reduction (from life cycle analysis)
			3,227	units reduced

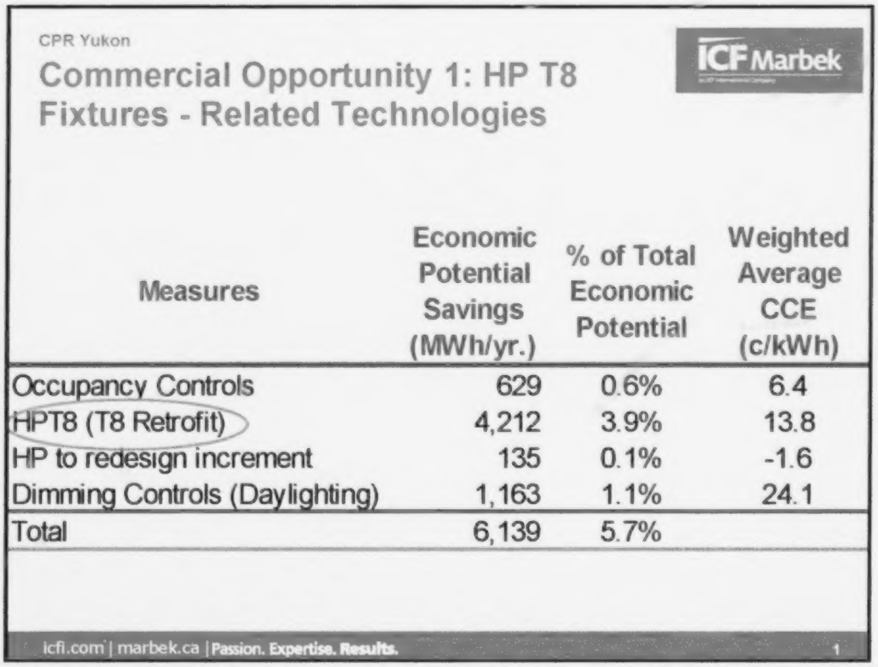
Appendix H Background-Section 10: Achievable Potential - Electric Energy Forecast

Introduction

Appendix H provides additional detailed information related to the generation of the Commercial sector Achievable Potential forecasts, including background material provided to achievable workshop participants. The appendix includes the following:

- Commercial achievable workshop action profile slides
- Commercial achievable workshop measure worksheets
- Detailed upper and lower achievable potential results.

H1 Achievable Workshop Action Profile Slides

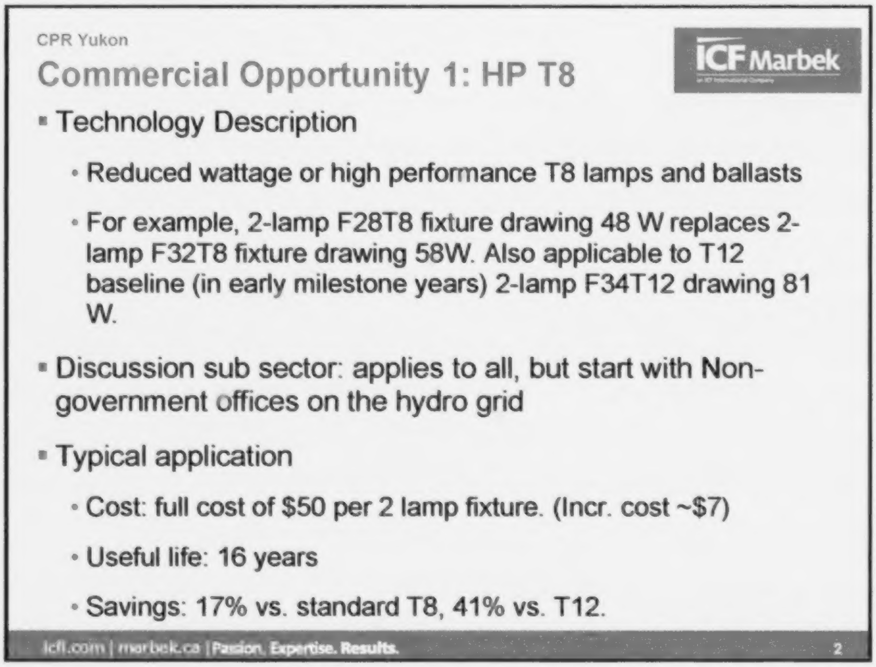


CPR Yukon

ICF Marbek

Commercial Opportunity 1: HP T8 Fixtures - Related Technologies

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
Occupancy Controls	629	0.6%	6.4
HPT8 (T8 Retrofit)	4,212	3.9%	13.8
HP to redesign increment	135	0.1%	-1.6
Dimming Controls (Daylighting)	1,163	1.1%	24.1
Total	6,139	5.7%	

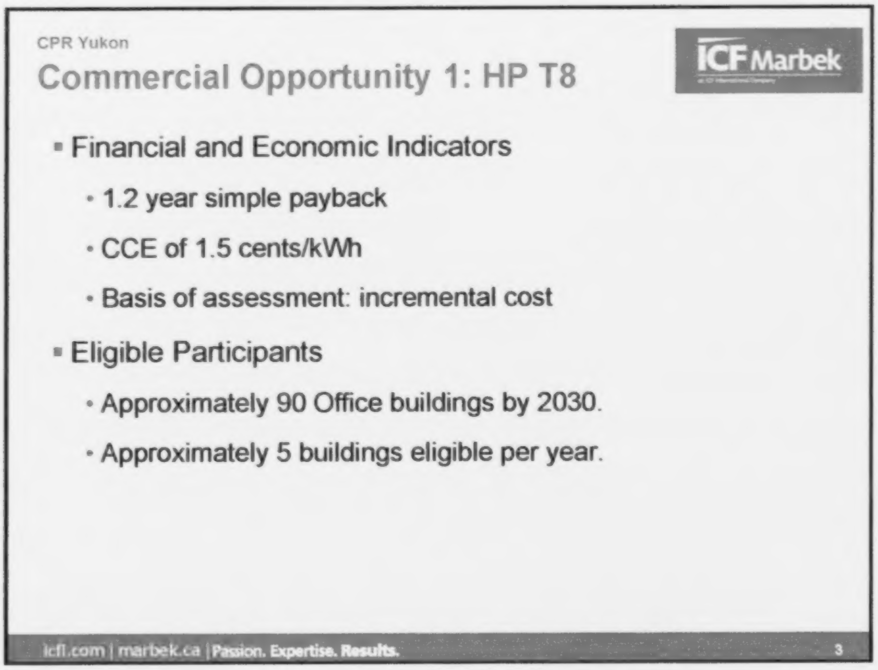


CPR Yukon

ICF Marbek

Commercial Opportunity 1: HP T8

- Technology Description
  - Reduced wattage or high performance T8 lamps and ballasts
  - For example, 2-lamp F28T8 fixture drawing 48 W replaces 2-lamp F32T8 fixture drawing 58W. Also applicable to T12 baseline (in early milestone years) 2-lamp F34T12 drawing 81 W.
- Discussion sub sector: applies to all, but start with Non-government offices on the hydro grid
- Typical application
  - Cost: full cost of $50 per 2 lamp fixture. (Incr. cost ~$7)
  - Useful life: 16 years
  - Savings: 17% vs. standard T8, 41% vs. T12.

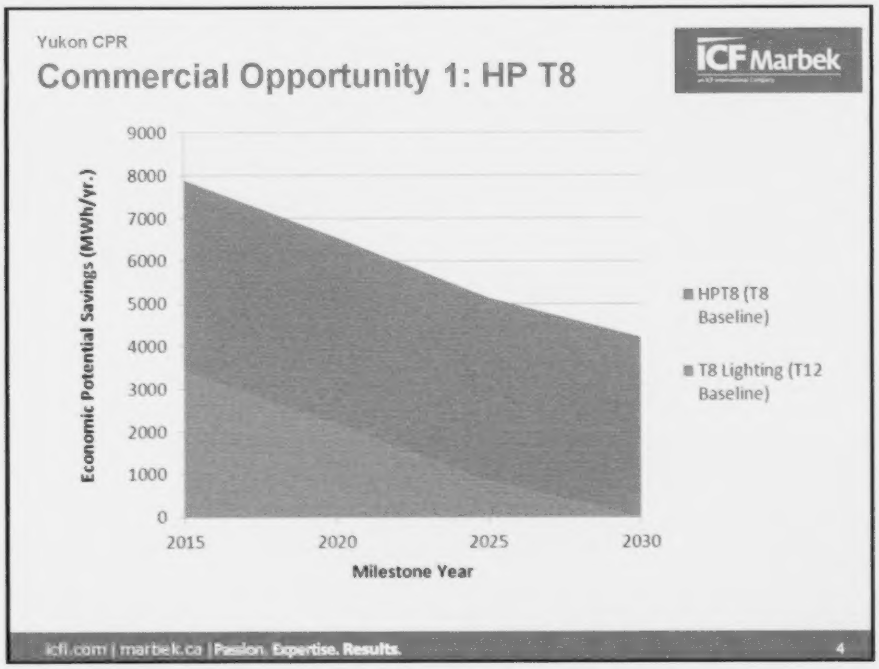


CPR Yukon

Commercial Opportunity 1: HP T8

ICF Marbek

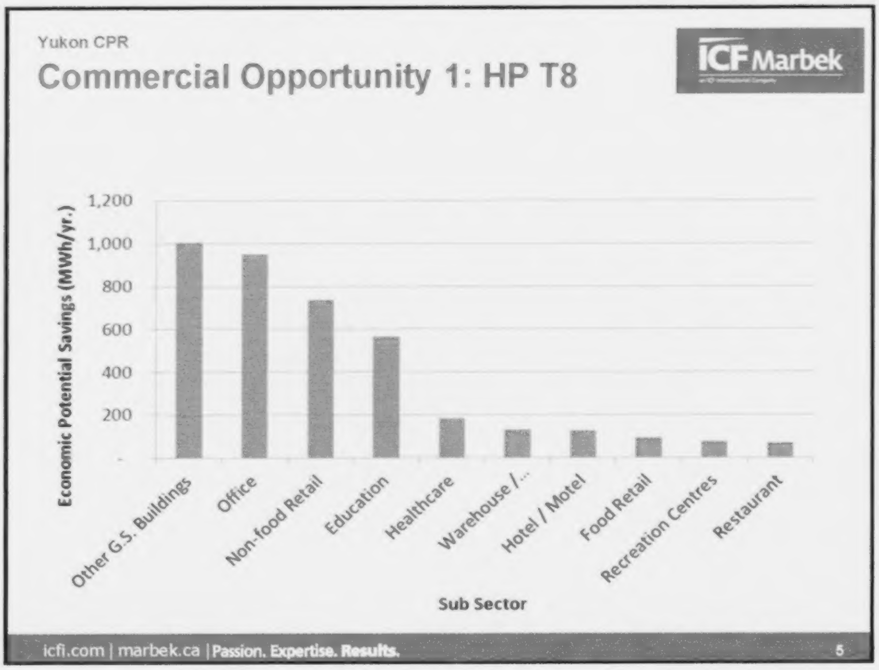
- Financial and Economic Indicators
  - 1.2 year simple payback
  - CCE of 1.5 cents/kWh
  - Basis of assessment: incremental cost
- Eligible Participants
  - Approximately 90 Office buildings by 2030.
  - Approximately 5 buildings eligible per year.



Yukon CPR

Commercial Opportunity 1: HP T8

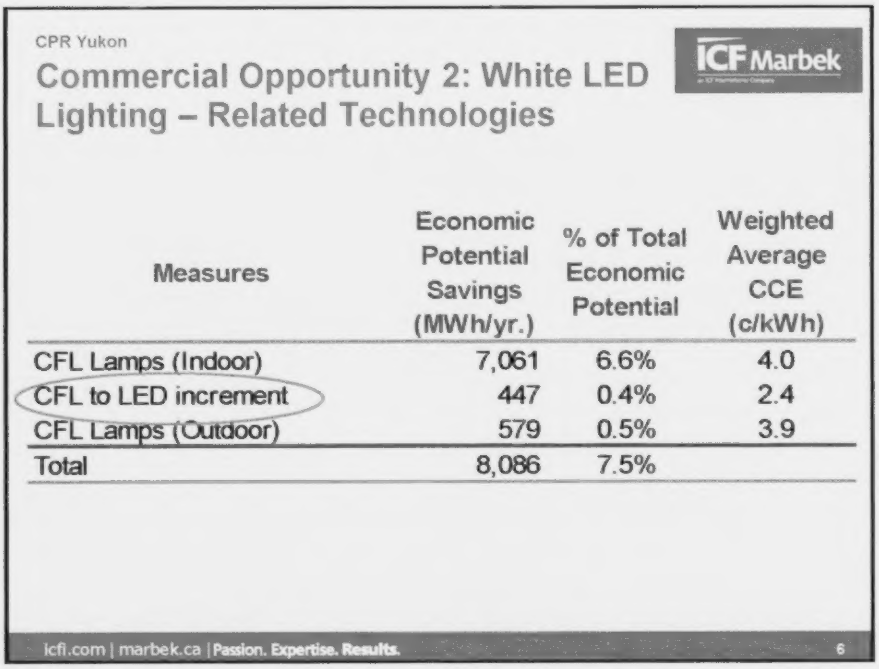
ICF Marbek



Yukon CPR

Commercial Opportunity 1: HP T8

ICF Marbek

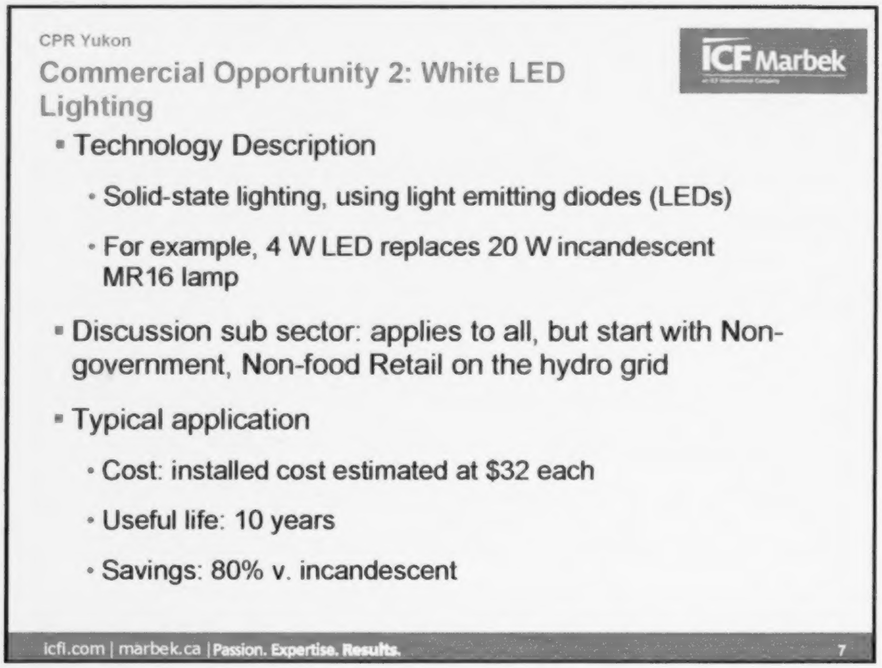


CPR Yukon

Commercial Opportunity 2: White LED Lighting – Related Technologies

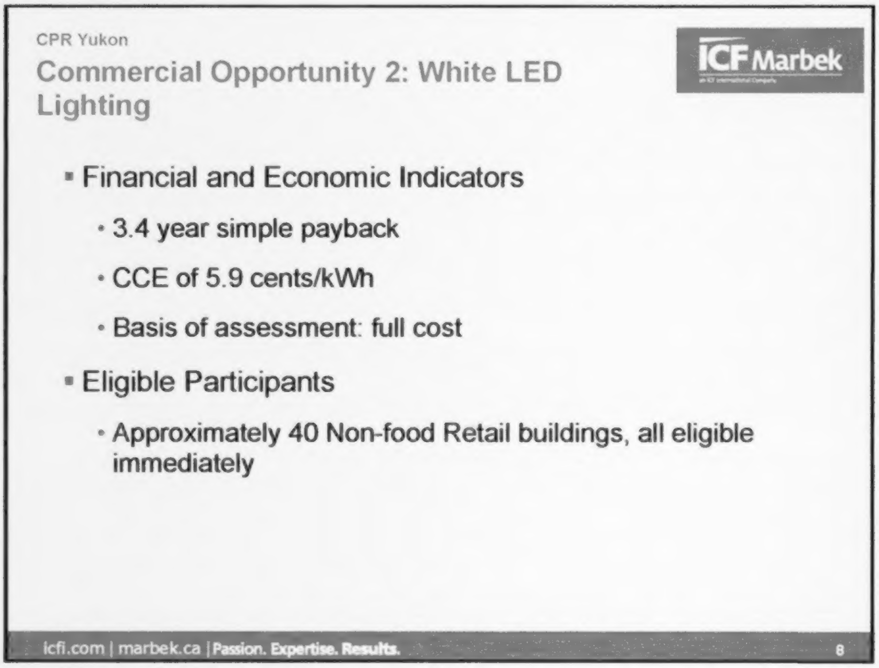
ICF Marbek

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
CFL Lamps (Indoor)	7,061	6.6%	4.0
CFL to LED increment	447	0.4%	2.4
CFL Lamps (Outdoor)	579	0.5%	3.9
Total	8,086	7.5%	



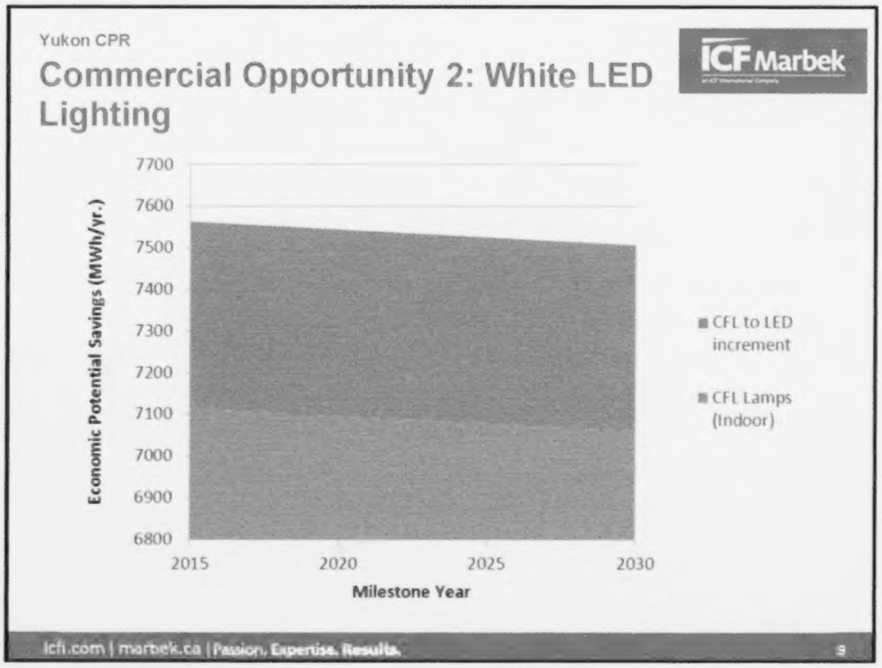
Commercial Opportunity 2: White LED Lighting

- Technology Description
  - Solid-state lighting, using light emitting diodes (LEDs)
  - For example, 4 W LED replaces 20 W incandescent MR16 lamp
- Discussion sub sector: applies to all, but start with Non-government, Non-food Retail on the hydro grid
- Typical application
  - Cost: installed cost estimated at $32 each
  - Useful life: 10 years
  - Savings: 80% v. incandescent



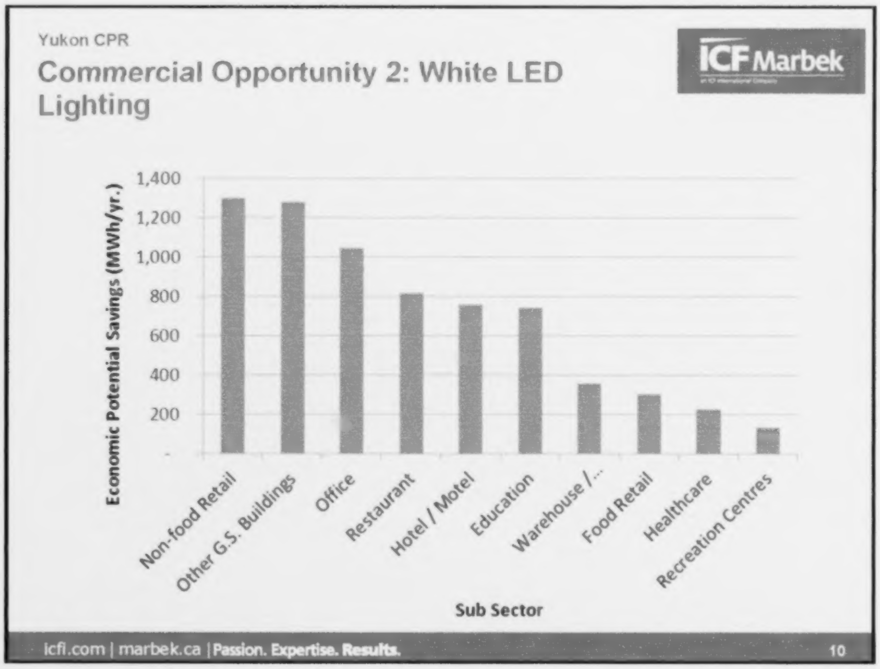
Commercial Opportunity 2: White LED Lighting

- Financial and Economic Indicators
  - 3.4 year simple payback
  - CCE of 5.9 cents/kWh
  - Basis of assessment: full cost
- Eligible Participants
  - Approximately 40 Non-food Retail buildings, all eligible immediately



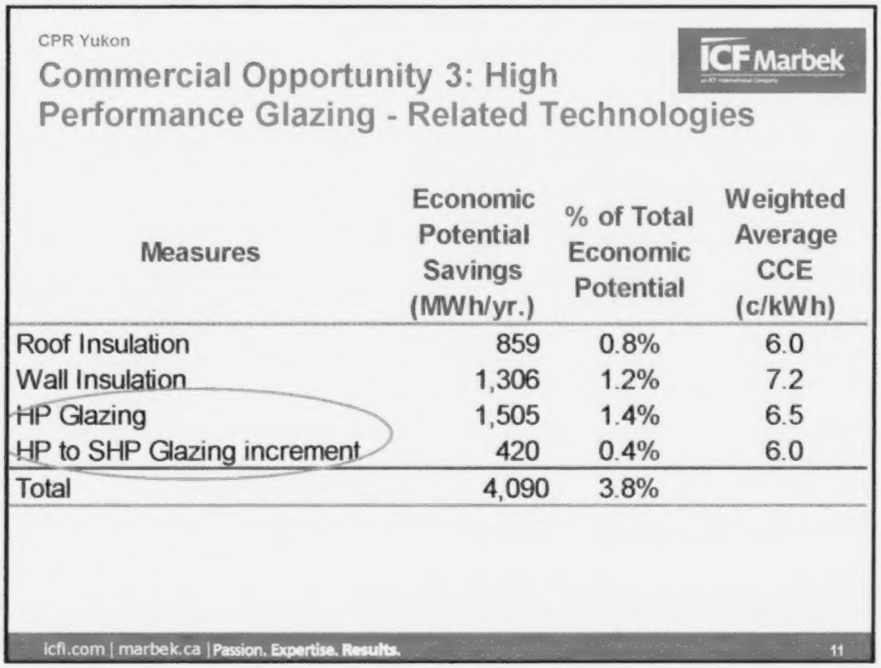
Yukon CPR

Commercial Opportunity 2: White LED Lighting



Yukon CPR

Commercial Opportunity 2: White LED Lighting

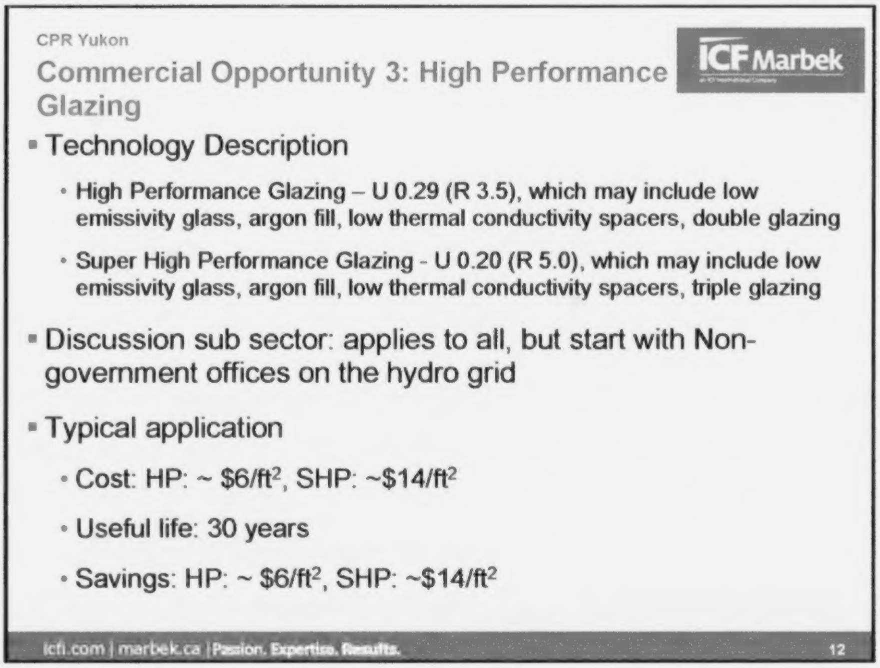


CPR Yukon

Commercial Opportunity 3: High Performance Glazing - Related Technologies

ICF Marbek

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
Roof Insulation	859	0.8%	6.0
Wall Insulation	1,306	1.2%	7.2
HP Glazing	1,505	1.4%	6.5
HP to SHP Glazing increment	420	0.4%	6.0
Total	4,090	3.8%	

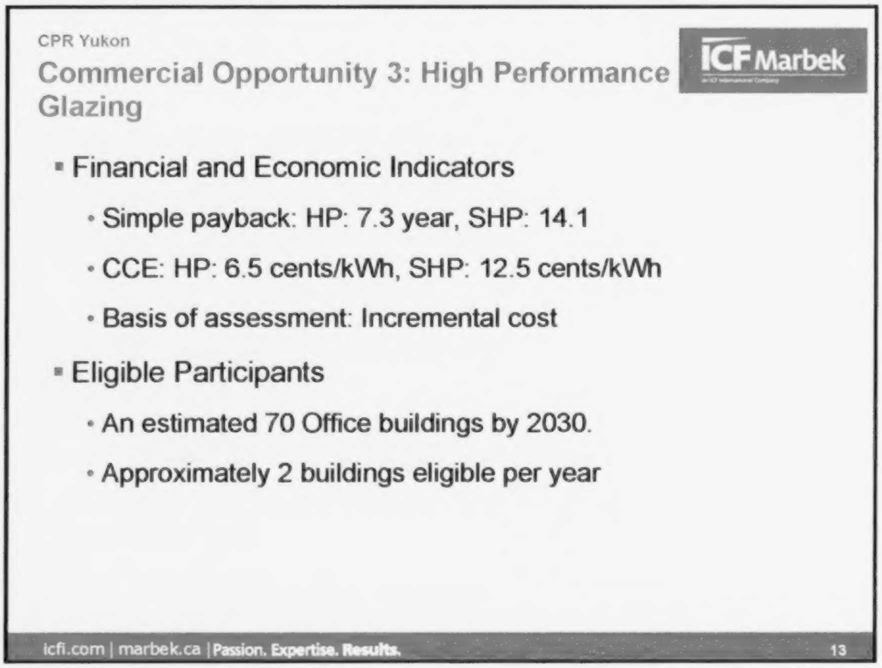


CPR Yukon

Commercial Opportunity 3: High Performance Glazing

ICF Marbek

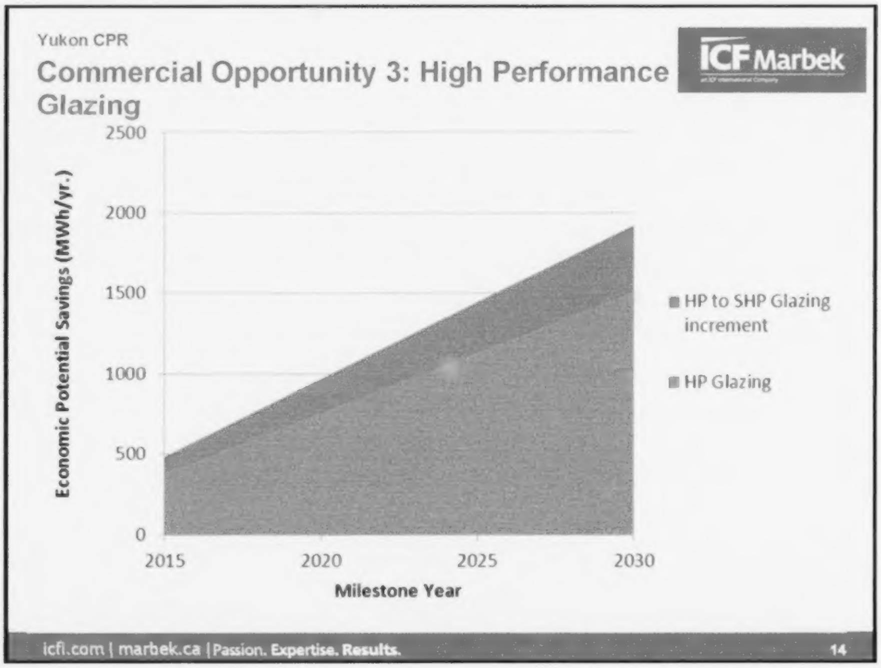
- Technology Description
  - High Performance Glazing – U 0.29 (R 3.5), which may include low emissivity glass, argon fill, low thermal conductivity spacers, double glazing
  - Super High Performance Glazing - U 0.20 (R 5.0), which may include low emissivity glass, argon fill, low thermal conductivity spacers, triple glazing
- Discussion sub sector: applies to all, but start with Non-government offices on the hydro grid
- Typical application
  - Cost: HP: ~ \$6/ft^2, SHP: ~\$14/ft^2
  - Useful life: 30 years
  - Savings: HP: ~ \$6/ft^2, SHP: ~\$14/ft^2



CPR Yukon

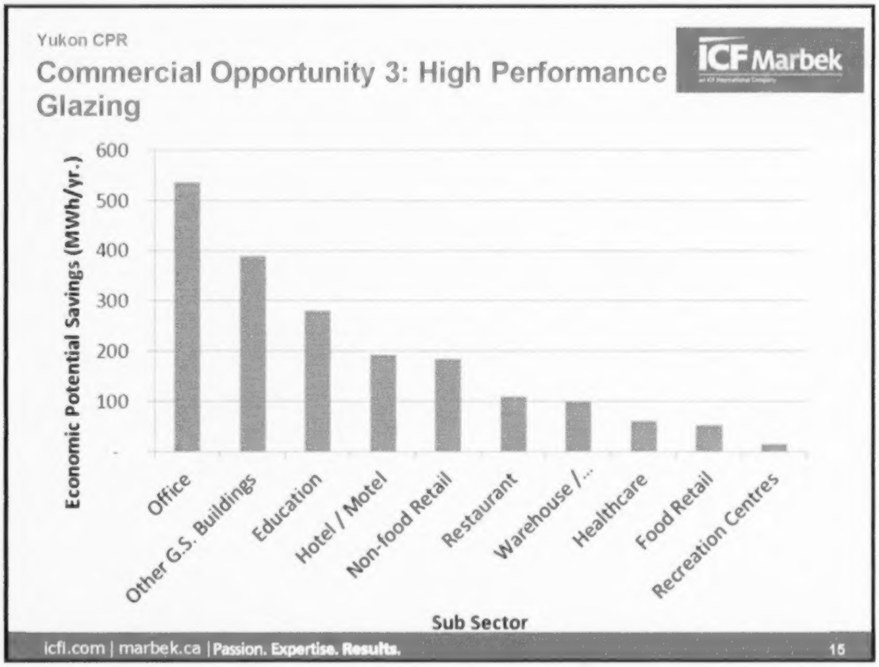
Commercial Opportunity 3: High Performance Glazing

- Financial and Economic Indicators
  - Simple payback: HP: 7.3 year, SHP: 14.1
  - CCE: HP: 6.5 cents/kWh, SHP: 12.5 cents/kWh
  - Basis of assessment: Incremental cost
- Eligible Participants
  - An estimated 70 Office buildings by 2030.
  - Approximately 2 buildings eligible per year



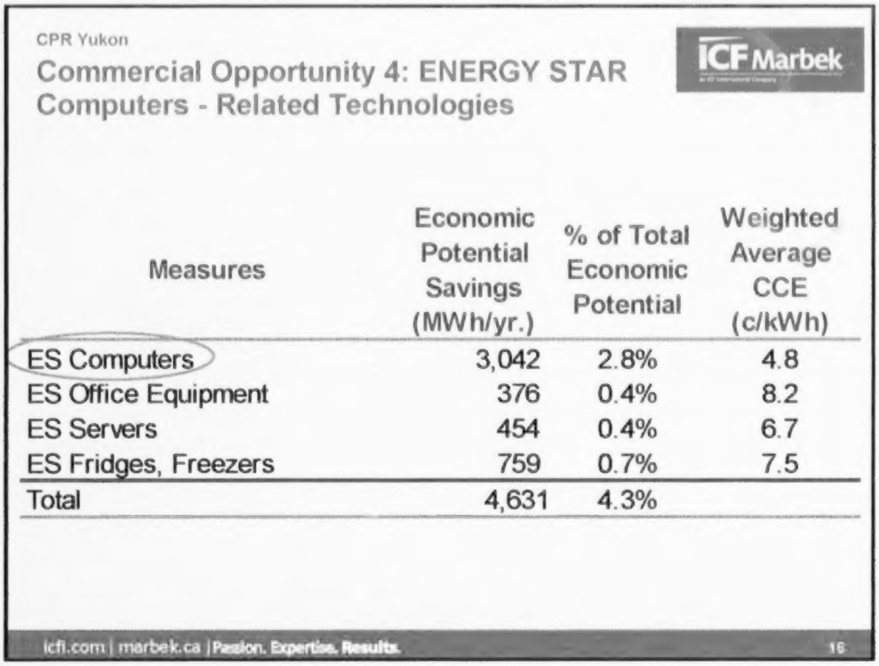
Yukon CPR

Commercial Opportunity 3: High Performance Glazing



Yukon CPR

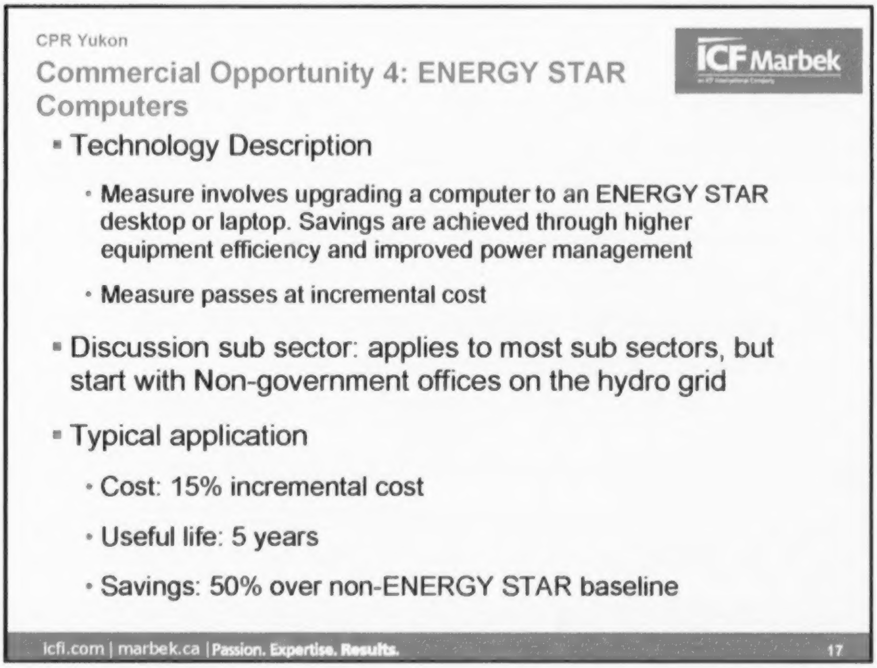
Commercial Opportunity 3: High Performance Glazing



CPR Yukon

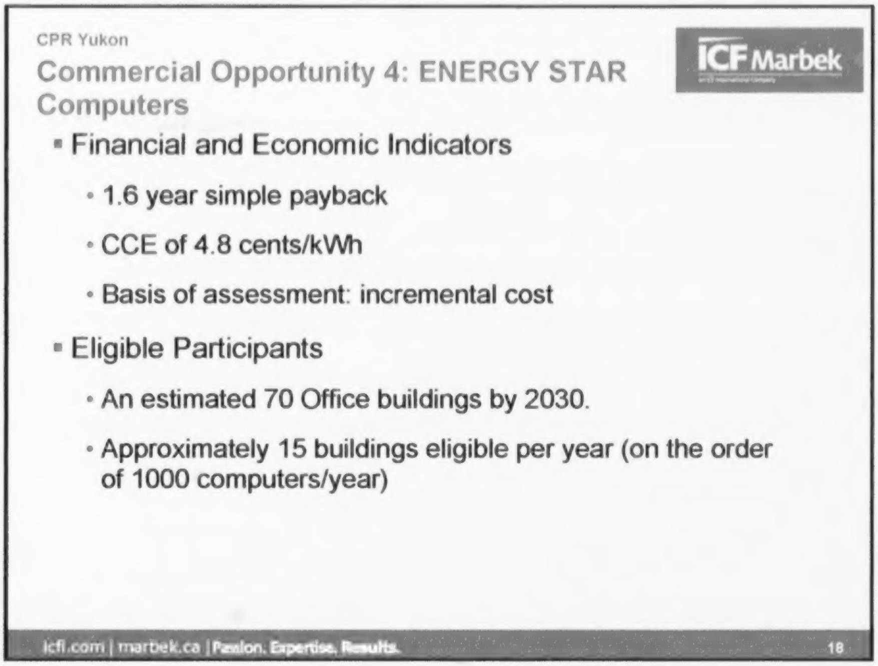
Commercial Opportunity 4: ENERGY STAR Computers - Related Technologies

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
ES Computers	3,042	2.8%	4.8
ES Office Equipment	376	0.4%	8.2
ES Servers	454	0.4%	6.7
ES Fridges, Freezers	759	0.7%	7.5
Total	4,631	4.3%	



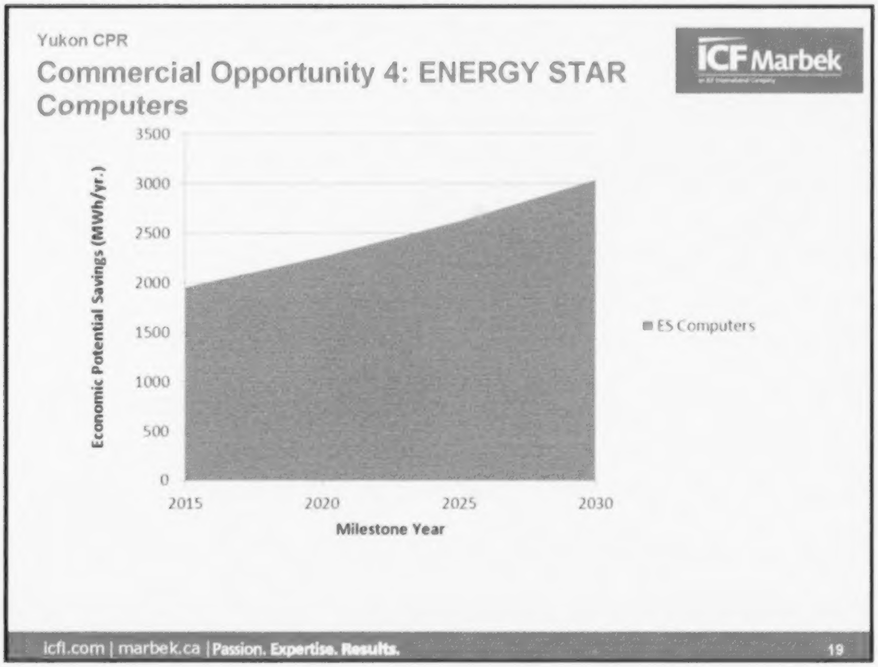
Commercial Opportunity 4: ENERGY STAR Computers

- Technology Description
  - Measure involves upgrading a computer to an ENERGY STAR desktop or laptop. Savings are achieved through higher equipment efficiency and improved power management
  - Measure passes at incremental cost
- Discussion sub sector: applies to most sub sectors, but start with Non-government offices on the hydro grid
- Typical application
  - Cost: 15% incremental cost
  - Useful life: 5 years
  - Savings: 50% over non-ENERGY STAR baseline



Commercial Opportunity 4: ENERGY STAR Computers

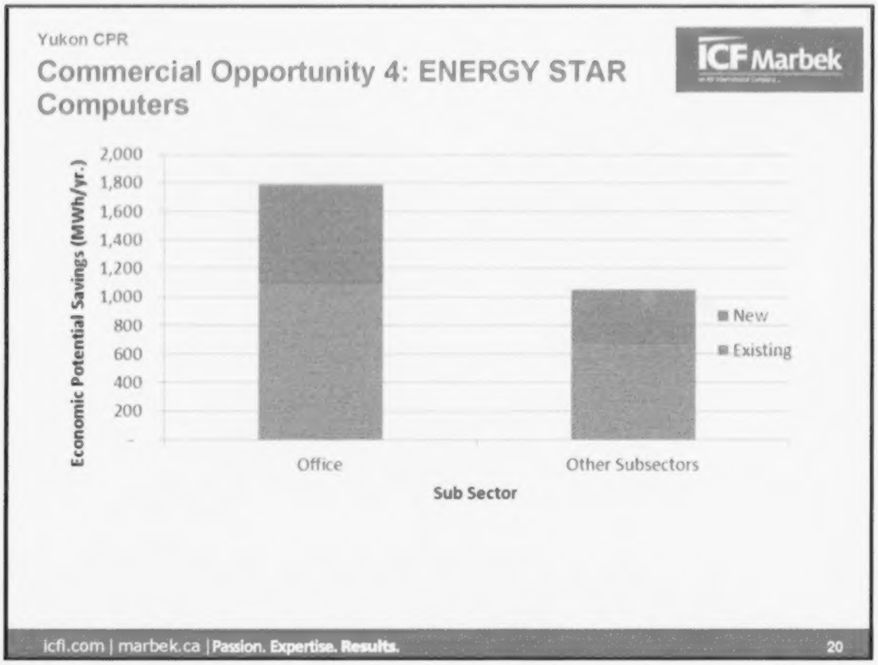
- Financial and Economic Indicators
  - 1.6 year simple payback
  - CCE of 4.8 cents/kWh
  - Basis of assessment: incremental cost
- Eligible Participants
  - An estimated 70 Office buildings by 2030.
  - Approximately 15 buildings eligible per year (on the order of 1000 computers/year)



Yukon CPR

Commercial Opportunity 4: ENERGY STAR Computers

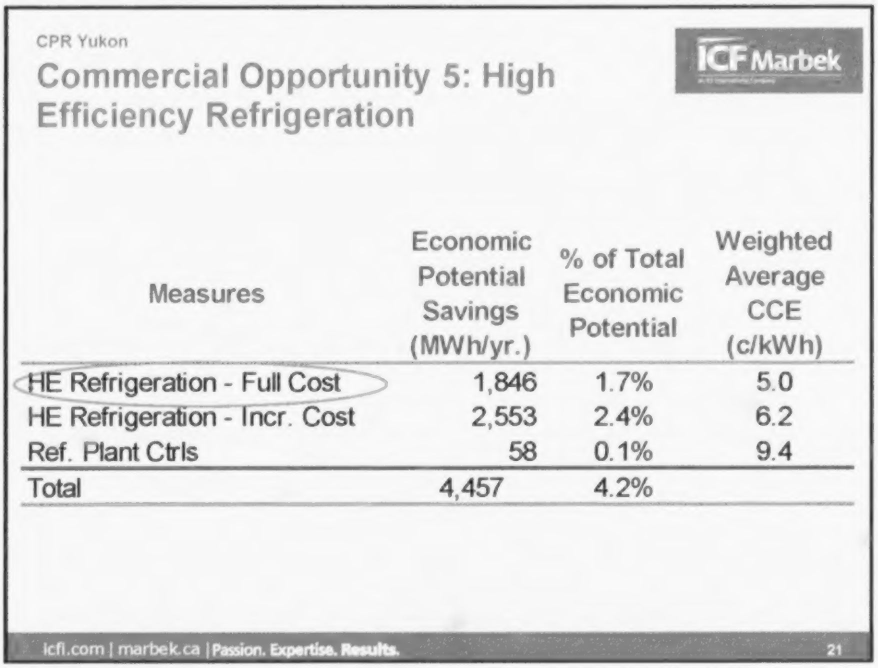
icfi.com | marbek.ca | **Passion. Expertise. Results.**



Yukon CPR

Commercial Opportunity 4: ENERGY STAR Computers

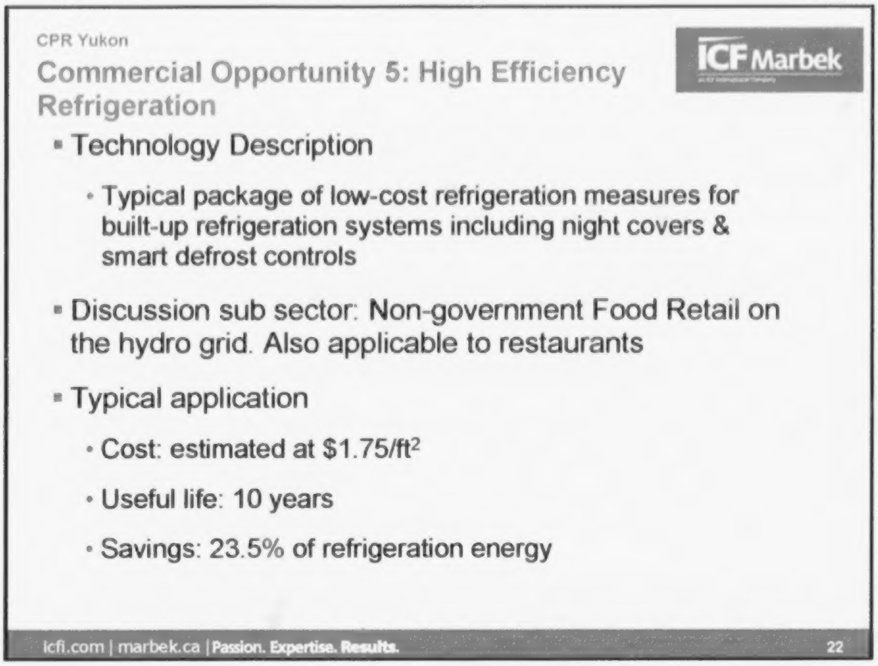
icfi.com | marbek.ca | **Passion. Expertise. Results.**



CPR Yukon

Commercial Opportunity 5: High Efficiency Refrigeration

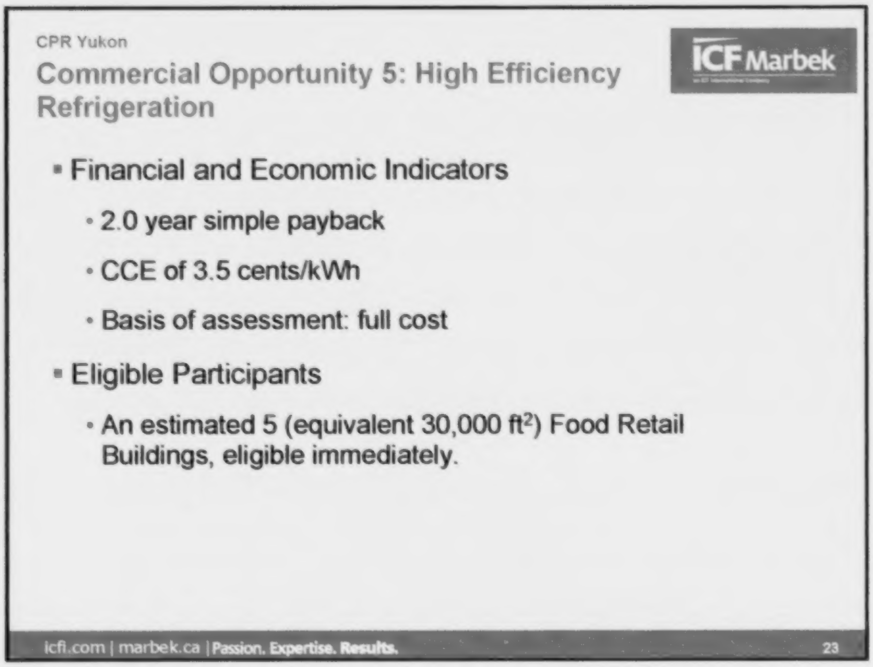
Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
HE Refrigeration - Full Cost	1,846	1.7%	5.0
HE Refrigeration - Incr. Cost	2,553	2.4%	6.2
Ref. Plant Ctrls	58	0.1%	9.4
Total	4,457	4.2%	



CPR Yukon

Commercial Opportunity 5: High Efficiency Refrigeration

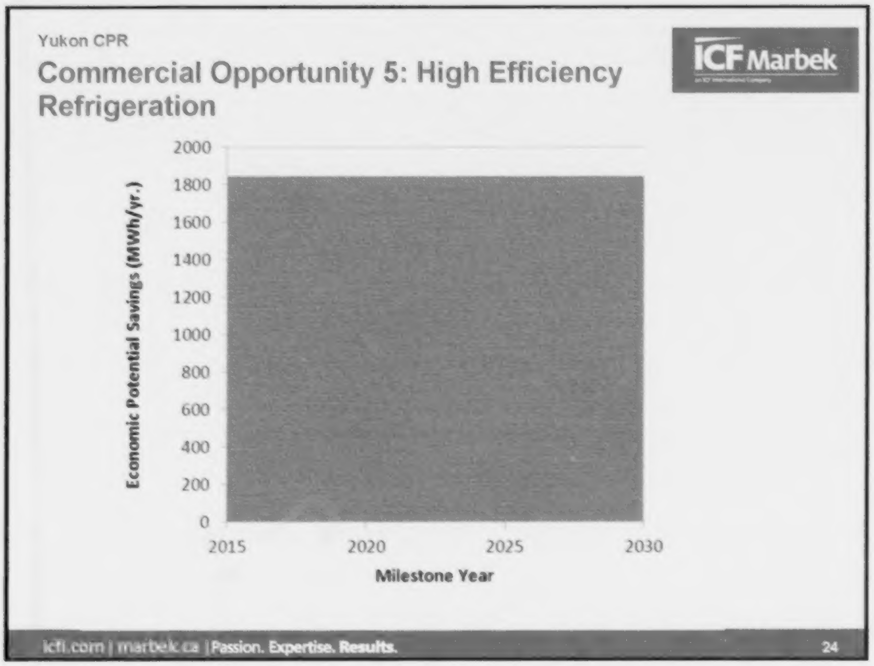
- Technology Description
  - Typical package of low-cost refrigeration measures for built-up refrigeration systems including night covers & smart defrost controls
- Discussion sub sector: Non-government Food Retail on the hydro grid. Also applicable to restaurants
- Typical application
  - Cost: estimated at $1.75/ft^2
  - Useful life: 10 years
  - Savings: 23.5% of refrigeration energy



CPR Yukon

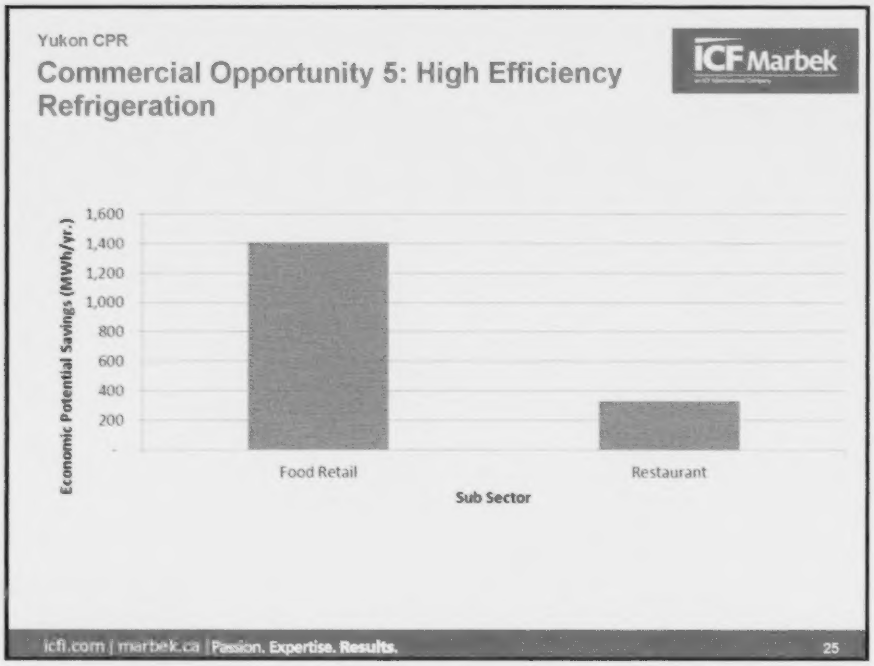
Commercial Opportunity 5: High Efficiency Refrigeration

- Financial and Economic Indicators
  - 2.0 year simple payback
  - CCE of 3.5 cents/kWh
  - Basis of assessment: full cost
- Eligible Participants
  - An estimated 5 (equivalent 30,000 ft²) Food Retail Buildings, eligible immediately.



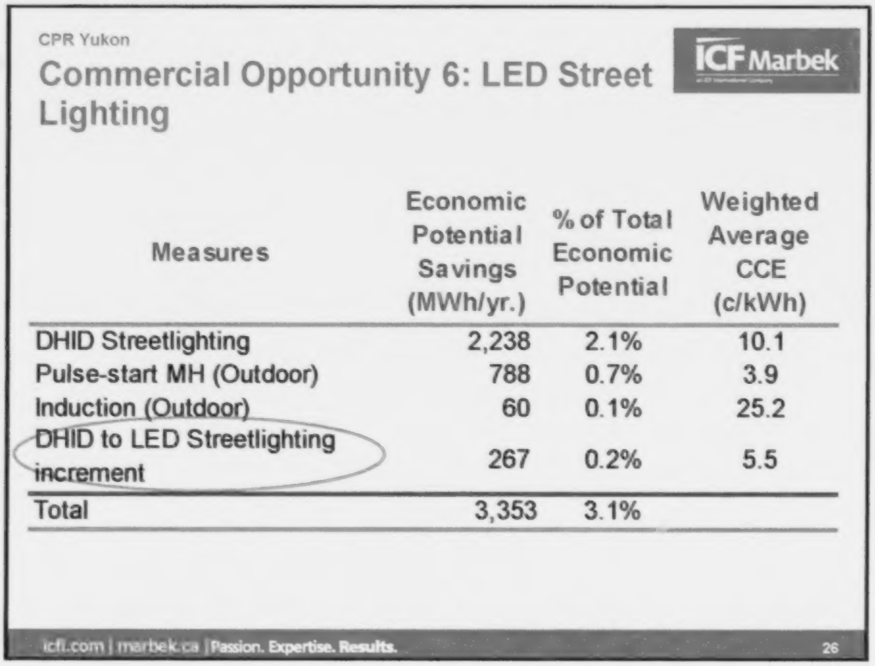
Yukon CPR

Commercial Opportunity 5: High Efficiency Refrigeration



Yukon CPR

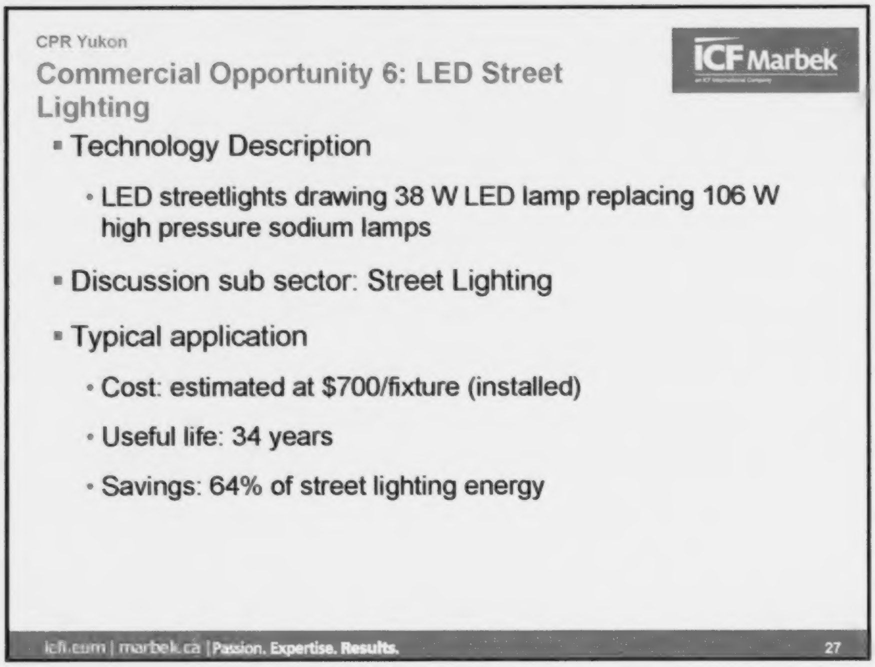
Commercial Opportunity 5: High Efficiency Refrigeration



CPR Yukon

Commercial Opportunity 6: LED Street Lighting

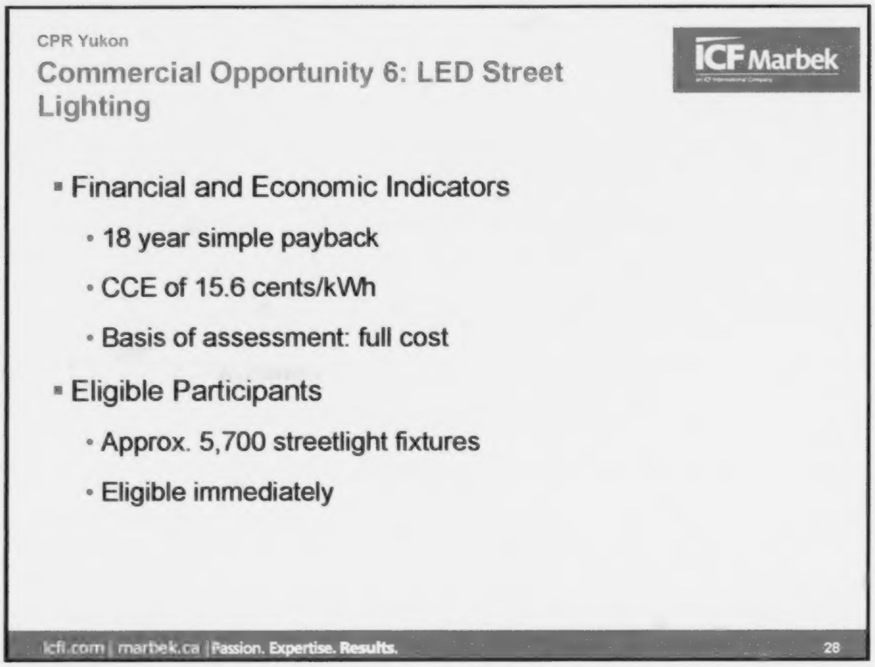
Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
DHID Streetlighting	2,238	2.1%	10.1
Pulse-start MH (Outdoor)	788	0.7%	3.9
Induction (Outdoor)	60	0.1%	25.2
DHID to LED Streetlighting increment	267	0.2%	5.5
Total	3,353	3.1%	



CPR Yukon

Commercial Opportunity 6: LED Street Lighting

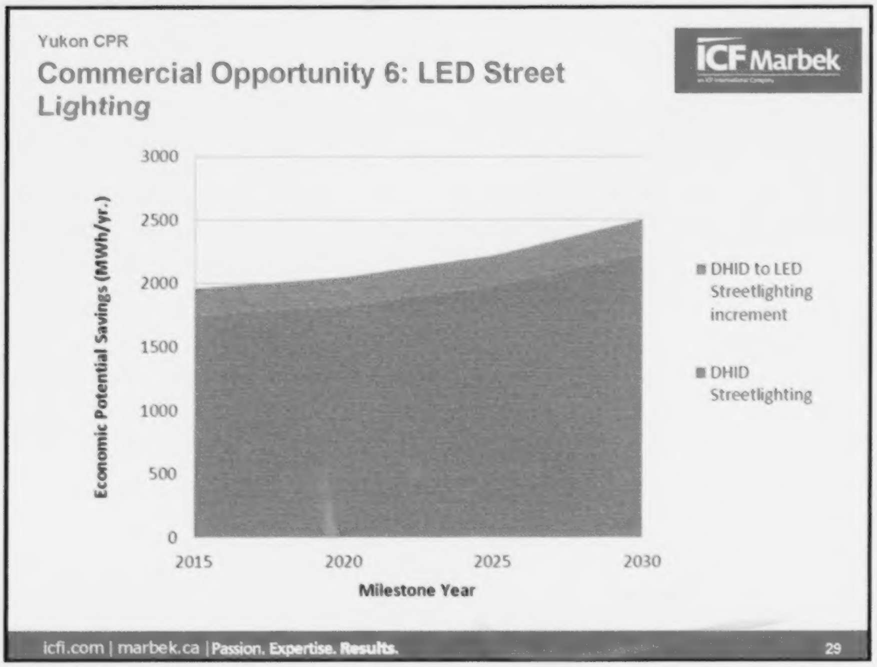
- Technology Description
  - LED streetlights drawing 38 W LED lamp replacing 106 W high pressure sodium lamps
- Discussion sub sector: Street Lighting
- Typical application
  - Cost: estimated at $700/fixture (installed)
  - Useful life: 34 years
  - Savings: 64% of street lighting energy



CPR Yukon

Commercial Opportunity 6: LED Street Lighting

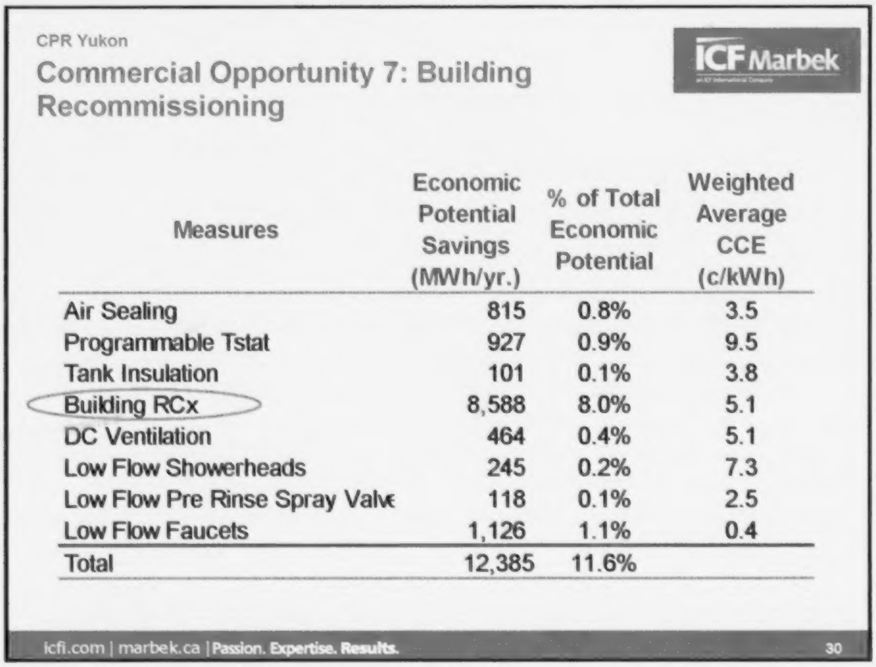
- Financial and Economic Indicators
  - 18 year simple payback
  - CCE of 15.6 cents/kWh
  - Basis of assessment: full cost
- Eligible Participants
  - Approx. 5,700 streetlight fixtures
  - Eligible immediately



Yukon CPR

Commercial Opportunity 6: LED Street Lighting

icfi.com | marbek.ca | **Passion. Expertise. Results.** 29

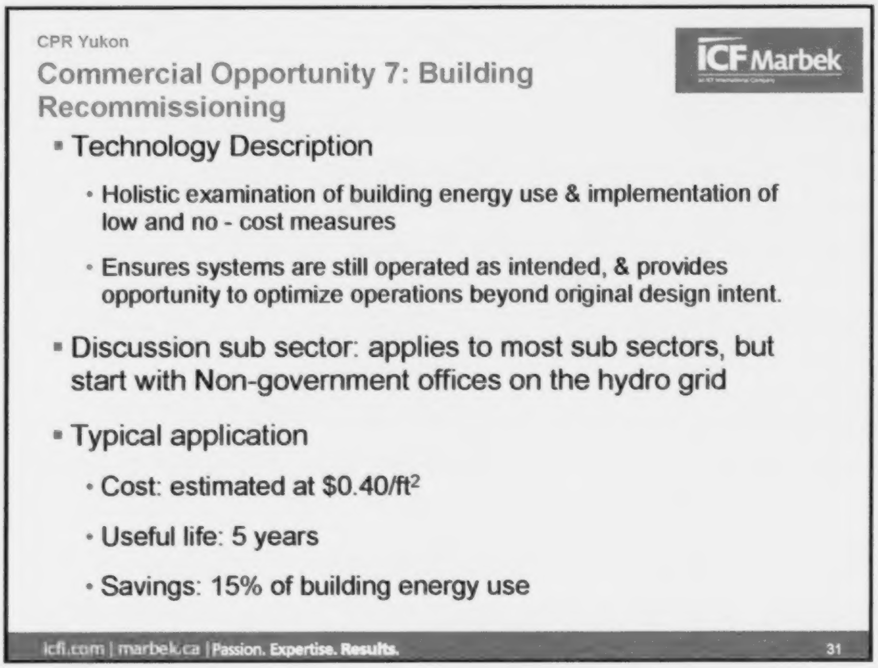


CPR Yukon

Commercial Opportunity 7: Building Recommissioning

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
Air Sealing	815	0.8%	3.5
Programmable Tstat	927	0.9%	9.5
Tank Insulation	101	0.1%	3.8
Building RCx	8,588	8.0%	5.1
DC Ventilation	464	0.4%	5.1
Low Flow Showerheads	245	0.2%	7.3
Low Flow Pre Rinse Spray Valv	118	0.1%	2.5
Low Flow Faucets	1,126	1.1%	0.4
Total	12,385	11.6%	

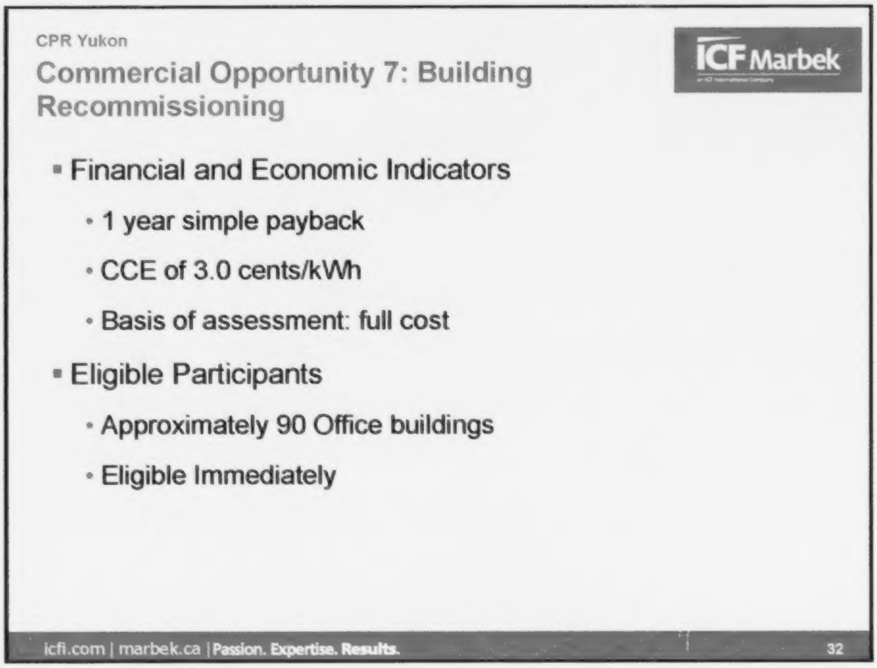
icfi.com | marbek.ca | **Passion. Expertise. Results.** 30



CPR Yukon

Commercial Opportunity 7: Building Recommissioning

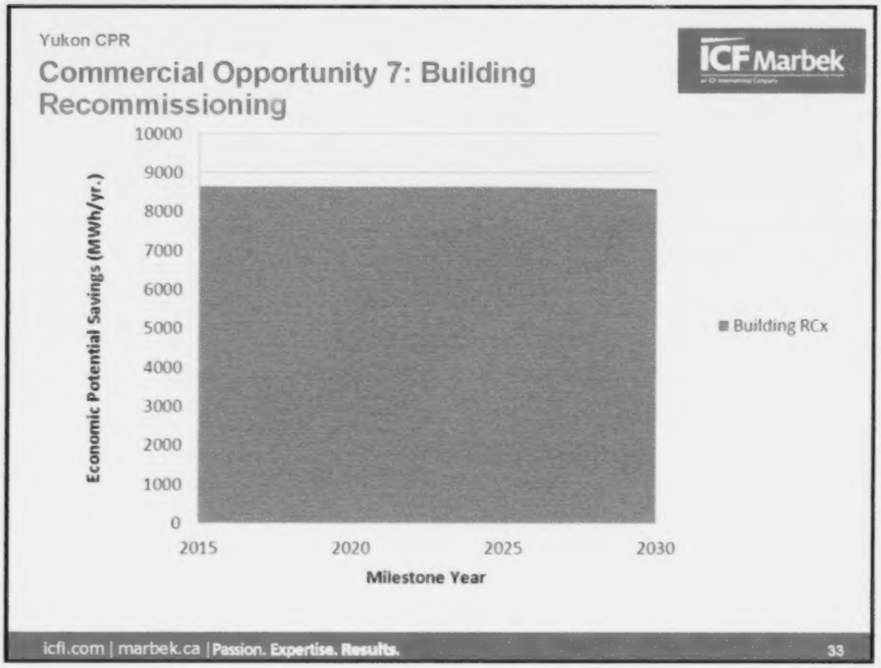
- Technology Description
  - Holistic examination of building energy use & implementation of low and no - cost measures
  - Ensures systems are still operated as intended, & provides opportunity to optimize operations beyond original design intent.
- Discussion sub sector: applies to most sub sectors, but start with Non-government offices on the hydro grid
- Typical application
  - Cost: estimated at $0.40/ft^2$
  - Useful life: 5 years
  - Savings: 15% of building energy use



CPR Yukon

Commercial Opportunity 7: Building Recommissioning

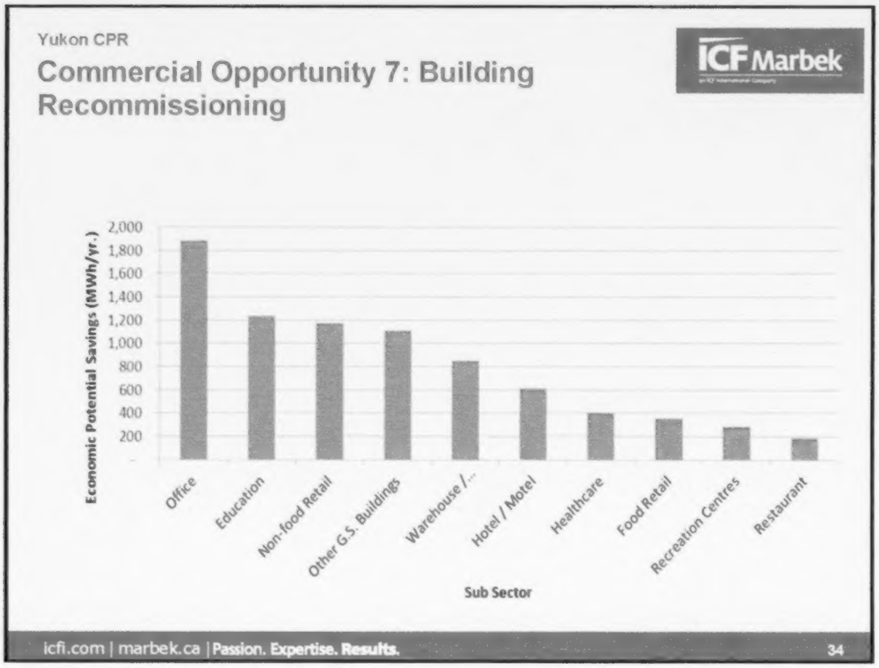
- Financial and Economic Indicators
  - 1 year simple payback
  - CCE of 3.0 cents/kWh
  - Basis of assessment: full cost
- Eligible Participants
  - Approximately 90 Office buildings
  - Eligible Immediately



Yukon CPR

Commercial Opportunity 7: Building Recommissioning

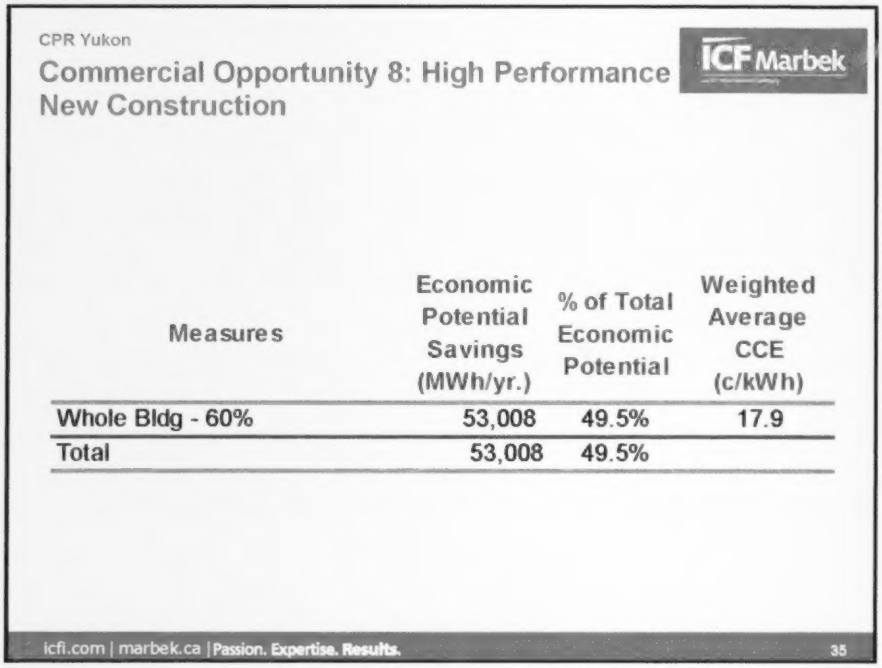
icfi.com | marbek.ca | **Passion. Expertise. Results.** 33



Yukon CPR

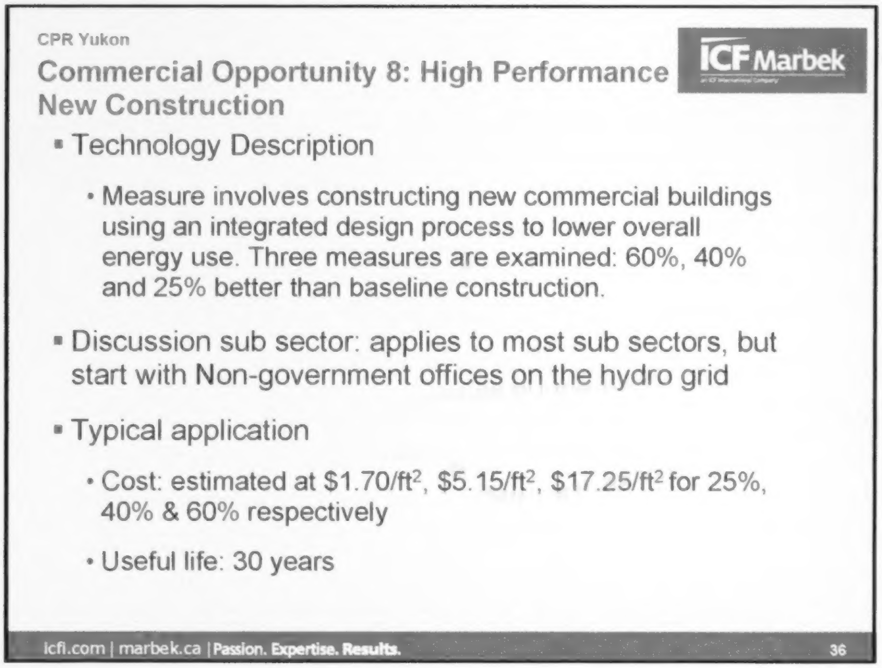
Commercial Opportunity 7: Building Recommissioning

icfi.com | marbek.ca | **Passion. Expertise. Results.** 34



Commercial Opportunity 8: High Performance New Construction

Measures	Economic Potential Savings (MWh/yr.)	% of Total Economic Potential	Weighted Average CCE (c/kWh)
Whole Bldg - 60%	53,008	49.5%	17.9
Total	53,008	49.5%	



Commercial Opportunity 8: High Performance New Construction

- Technology Description
  - Measure involves constructing new commercial buildings using an integrated design process to lower overall energy use. Three measures are examined: 60%, 40% and 25% better than baseline construction.
- Discussion sub sector: applies to most sub sectors, but start with Non-government offices on the hydro grid
- Typical application
  - Cost: estimated at \$1.70/ft^2, \$5.15/ft^2, \$17.25/ft^2 for 25%, 40% & 60% respectively
  - Useful life: 30 years

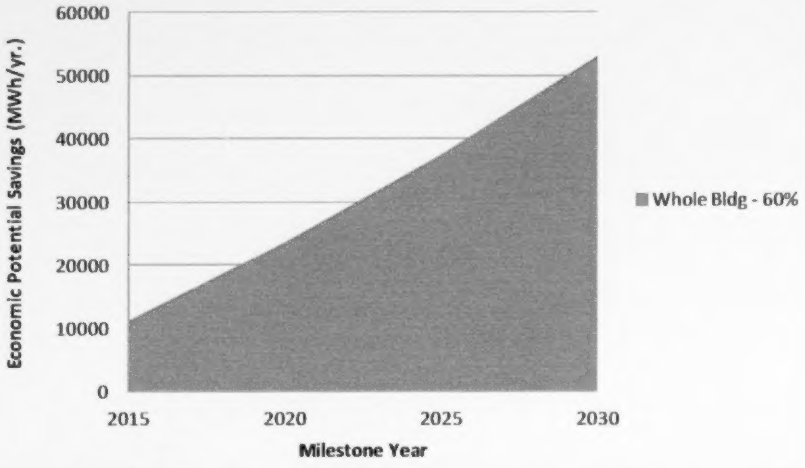
CPR Yukon

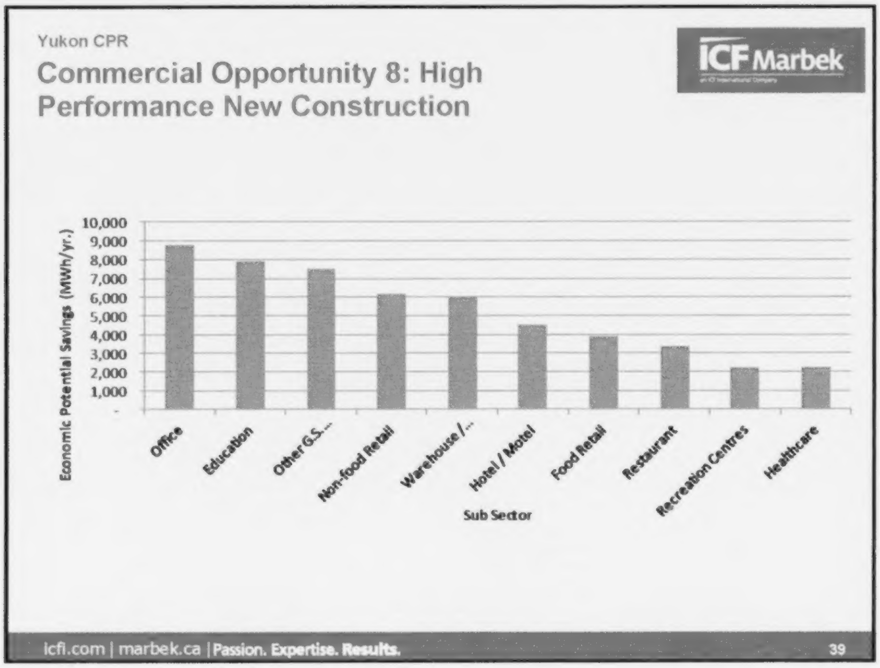
Commercial Opportunity 8: High Performance New Construction

- Financial and Economic Indicators
  - 2.8, 5.2 & 11.5 year simple paybacks
  - CCEs of 2.4, 4.6, 10.2 cents/kWh
  - Basis of assessment: incremental cost
- Eligible Participants
  - Approx. 380 equivalent 15,000 ft^2 buildings by 2030, including all Yukon. 15 -20 buildings/year.
  - Eligible at time of construction

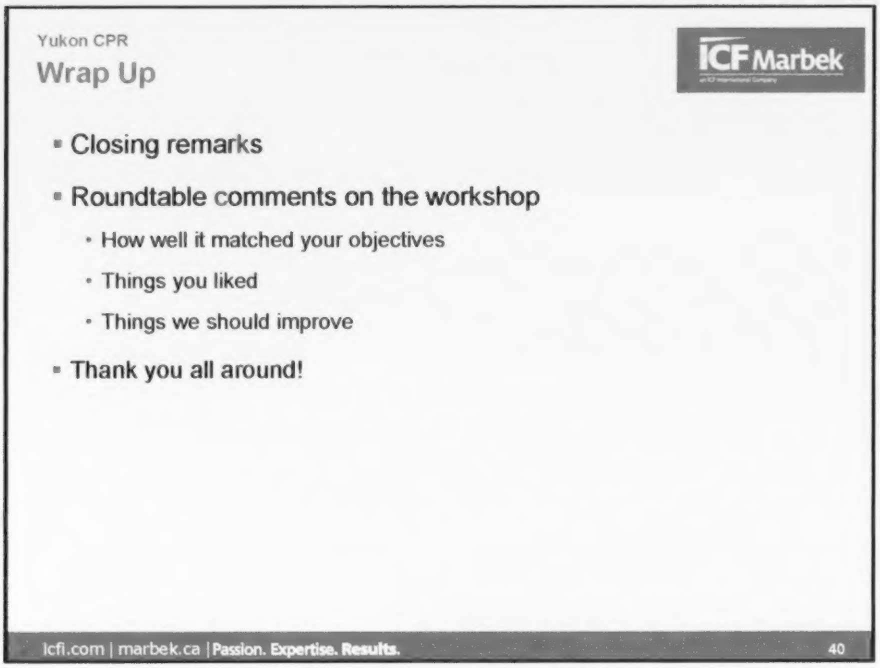
Yukon CPR

Commercial Opportunity 8: High Performance New Construction





Commercial Opportunity 8: High Performance New Construction



Wrap Up

- Closing remarks
- Roundtable comments on the workshop
  - How well it matched your objectives
  - Things you liked
  - Things we should improve
- Thank you all around!

H2 Achievable Workshop Measure Worksheets

Commercial Sector
C1 -- High Performance T8s

Sub Sector for Discussion: RW T8 > Large Office > Existing > Hydro				
Measure information	CCE (¢/kWh)	1.5	Incremental Cost	
	Approx. Payback (years)	1		
Approximate Economic Savings Potential (MWh/yr) in 2015		7,900	Includes T12 -> RW T8	
Approximate Economic Savings Potential (MWh/yr) in 2030		4,200		
Market Size	Total ft^2 (approx.)	1,360,000	(Incl. Gov't & Non-Gov't)	
	Total # of sites	90	Eq. 15,000 ft^2 **buildings**	
	% eligible	95%	Exclude "can't" + current	
	# eligible sites/yr.	5		
	# eligible sites by 2030	90		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
HP T8	Low		50%	Curve A/B
	High		95%	Curve A/B
Achievable Potential (# Buildings)				
HP T8	Low	0	3	
	High	0	5	

Participation Rates for Other Regions / Subsectors (H=higher; L=lower; S=same; N/A=not applicable)

Office		**Government**	a bit higher or same
Food Retail	higher		
Non-Food Retail	same	**Diesel Grids**	lower
Hotel / Motel	same		
Education	higher	**Standard T8 (T12 baseline)**	
Restaurant	lower		
Recreation Centres	same		
Warehouse / Wholesale	same		

Commercial Sector
C2 -- White LEDs

Sub Sector for Discussion: White LEDs > Non-food Retail > Existing > Hydro				
Measure information	CCE (¢/kWh)	5.9	Full Cost	
	Approx. Payback (years)	3		
Approximate Economic Savings Potential (MWh/yr) in 2015		7,600	Includes Incandescent & CFL baseline	
Approximate Economic Savings Potential (MWh/yr) in 2030		7,500		
Market Size	Total ft^2 (approx.)	912,000		
	Total # of sites	50	Eq. 20,000 ft^2 **buildings**	
	% eligible	95%	Exclude "can't" + current	
	# eligible sites/yr.	40		
	# eligible sites by 2030	40		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
White LEDs	Low		50%	Curve B
	High		80%	Curve A/B
Achievable Potential (# Buildings)				
White LEDs	Low	0	20	
	High	0	32	

Participation Rates for Other Subsectors (H=higher; L=lower; S=same; N/A=not applicable)

Office	ors a bit lower than the big	**Government**	
Food Retail			
Non-Food Retail		**Diesel Grids**	a bit lower
Hotel / Motel			
Education		**CFL Lamps (Incandescent Baseline)**	y everyone who does
Restaurant			
Recreation Centres			
Warehouse / Wholesale			

Commercial Sector
C3 -- HP Glazing

Sub Sector for Discussion: HP Glazing > Office> Existing > Hydro				
Measure information	CCE (¢/kWh)	6.0, 12.5	HP/SHP, Incremental Cost	
	Approx. Payback (years)	7.3, 14.1	HP/SHP	
Approximate Economic Savings Potential (MWh/yr) in 2015		500		
Approximate Economic Savings Potential (MWh/yr) in 2030		2,000		
Market Size	Total ft^2 (approx.)	151,111	(Incl. Gov't & Non-Gov't)	
	Total # of sites	10	Eq. 15,000 ft^2 **buildings**	
	% eligible	80%	Exclude "can't" + current	
	# eligible sites/yr.	1		
	# eligible sites by 2030	8		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
SHP Glazing	Low		20%	Curve irrelevant
	High		70%	Curve A
Achievable Potential (# Sites)				
SHP Glazing	Low		1	
	High		2	
Remaining	Low		2	
	High		1	
HP Glazing	Low		0	
	High		0	
Total	Low	0	1	
	High	0	2	

Participation Rates for Other Subsectors (H=higher; L=lower; S=same; N/A=not applicable)			
Office		**Government**	same
Food Retail			
Non-Food Retail		**Diesel Grids**	n/a
Hotel / Motel			
Education		**Roof insulation**	
Restaurant		**Wall insulation**	
Recreation Centres			
Warehouse / Wholesale			

Commercial Sector
C4 -- ENERGY STAR Computers

Sub Sector for Discussion: ES Computers > Large Office > Existing > Hydro				
Measure information	CCE (¢/kWh)	4.8	Incremental Cost	
	Approx. Payback (years)	1.6		
Approximate Economic Savings Potential (MWh/yr) in 2015		2,000		
Approximate Economic Savings Potential (MWh/yr) in 2030		3,000		
Market Size	Total ft^2 (approx.)	1,364,000	(Incl. Gov't & Non-Gov't)	
	Total # of sites	90	Eq. 15,000 ft^2 **buildings**	
	% eligible	75%	Exclude "can't" + current	
	# eligible sites/yr.	14	Approx 1000 machines/year	
	# eligible sites by 2030	70		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
ENERGY STAR Computers	Low		25%	Curve B
	High		50%	Curve A
Achievable Potential (# Buildings)				
ENERGY STAR Computers	Low	0	4	
	High	0	7	

Participation Rates for Other Subsectors (H=higher; L=lower; S=same; N/A=not applicable)

Office		**Government**	D 100% 2010
Food Retail			
Non-Food Retail		**Diesel Grids**	
Hotel / Motel			
Education		**ENERGY STAR Office Equip.**	
Restaurant		**ENERGY STAR Servers**	
Recreation Centres		**ENERGY STAR Fridges/Freezers**	
Warehouse / Wholesale			

Commercial Sector
C5 -- HE Refrigeration - Full Cost Measures

Sub Sector for Discussion: HE Refrigeration > Large Office > Existing > Hydro				
Measure information	CCE (¢/kWh)	3.5	Full Cost	
	Approx. Payback (years)	2.0		
Approximate Economic Savings Potential (MWh/yr) in 2015		1,800		
Approximate Economic Savings Potential (MWh/yr) in 2030		1,800		
Market Size	Total ft^2 (approx.)	195,483		
	Total # of sites	7	Eq. 105,000 ft^2 **buildings**	
	% eligible	75%	Exclude "can't" + current	
	# eligible sites/yr.	5		
	# eligible sites by 2030	5		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
HE Refrigeration	Low		100%	Curve D by 2020
	High		100%	Curve D by 2015
Achievable Potential (# Buildings)				
HE Refrigeration	Low	0	5	
	High	0	5	

Participation Rates for Other Subsectors (H=higher; L=lower; S=same; N/A=not applicable)			
Office		**Government**	
Food Retail			
Non-Food Retail		**Diesel Grids**	higher
Hotel / Motel			
Education		**HE Refrigeration - Incremental Cost**	
Restaurant	lower		
Recreation Centres			
Warehouse / Wholesale			

Commercial Sector
C6 -- LED Streetlighting

Sub Sector for Discussion: LED Streetlighting > Existing				
Measure information	CCE (¢/kWh)	15.6	Full Cost	
	Approx. Payback (years)	18.0		
Approximate Economic Savings Potential (MWh/yr) in 2015		2,500		
Approximate Economic Savings Potential (MWh/yr) in 2030		2,500		
Market Size	Total ft^2 (approx.)	n/a		
	Total # of sites	5,700		
	% eligible	100%		
	# eligible sites	5,700		
	# eligible sites by 2030	5,700		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
LED Street Lighting	Low		100%	Curve B
	High		100%	Curve B
Achievable Potential (# Lamps)				
LED Street Lighting	Low	0	5,700	
	High	0	5,700	

Participation Rates for Other Subsectors (H=higher; L=lower; S=same; N/A=not applicable)

Office		**Government**	
Food Retail			
Non-Food Retail		**Diesel Grids**	same
Hotel / Motel			
Education		**DHID**	
Restaurant		**Pulse Start MH (Outdoor)**	
Recreation Centres			
Warehouse / Wholesale			

Commercial Sector
C7 -- Recommissioning

Sub Sector for Discussion: RCx > Office > Existing > Hydro				
Measure information	CCE (¢/kWh)	3.0	Full Cost	
	Approx. Payback (years)	1.0		
Approximate Economic Savings Potential (MWh/yr) in 2015		8,600		
Approximate Economic Savings Potential (MWh/yr) in 2030		8,600		
Market Size	Total ft^2 (approx.)	1,364,000		
	Total # of sites	90	Eq. 15,000 ft^2 **buildings**	
	% eligible	33%	Exclude "can't" + current	
	# eligible sites	30		
	# eligible sites by 2030	30		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
RCx	Low		40%	Curve B
	High		80%	Curve B
Achievable Potential (# Buildings)				
RCx	Low	0	12	
	High	0	24	
Total	Static	0	12	
	Aggressive	0	24	

Participation Rates for Other Measures (H=higher; L=lower; S=same; N/A=not applicable)

Office		**Government**	slower
Food Retail	same		
Non-Food Retail	same	**Diesel Grids**	
Hotel / Motel	same		
Education	same	**Programmable T'Stats**	
Restaurant	same	**Air Sealing**	
Recreation Centres	higher	**Low Flow Fixtures**	
Warehouse / Wholesale	same		

Commercial Sector
C8 -- Advanced New Construction Measures

Sub Sector for Discussion: New Construction > All Subsectors > New				
Measure information	CCE (¢/kWh)	4.0/7.6/16.8	25%/40%/60%	
	Approx. Payback (years)	4.9/9.2/20.5		
Approximate Economic Savings Potential (MWh/yr) in 2015		10,000		
Approximate Economic Savings Potential (MWh/yr) in 2030		53,000		
Market Size	Total # of sites (estimated)	380	Eq. 15,000 ft^2 **buildings**	
	% eligible	100%		
	# eligible sites per year	19		
	# eligible sites by 2030	380		
Participation Rates, by Year (% of Eligible Sites)		2015	2030	Curve
60% Better	Low		45%	Curve B
	High		95%	Curve B
Remaining	Low	19	10	
	High	19	1	
40% Better	Low		54%	
	High		100%	
Remaining	Low	19	5	
	High	19	0	
25% Better	Low		100%	
	High			
Achievable Potential (# Buildings)				
60% Better	Static	0	9	
	Aggressive	0	18	
40% Better	Static	0	6	
	Aggressive	0	1	
25% Better	Static	0	5	
	Aggressive	0	0	
Total	Static	0	19	
	Aggressive	0	19	
Participation Rates for Other Subsectors/Regions (H=higher; L=lower; S=same; N/A=not applicable)				
Office		**Government**		
Food Retail				
Non-Food Retail		**Diesel Grids**		
Hotel / Motel				
Education				
Restaurant				
Recreation Centres				
Warehouse / Wholesale				

H3 Detailed Achievable Potential Results

Exhibit H 1 and Exhibit H 2 provide detailed results for the hydro grid for the upper and lower Achievable Potential scenarios respectively.

Exhibit H 1 Total Upper Achievable Potential Electricity Savings by End Use, Sub Sector and Milestone Year (MWh/yr.) – Hydro Grid

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Office																		
2015	304	433	-	68	212	6	39	42	706	6	-	1	-	-	-	-	-	1,819
2020	717	779	-	147	770	34	178	99	946	17	-	7	-	-	-	-	-	3,695
2025	1,235	1,052	-	243	1,770	100	448	179	1,250	35	-	11	-	-	-	-	-	6,323
2030	1,987	1,279	-	366	3,325	224	890	295	1,631	62	-	17	-	-	-	-	-	10,076
Food Retail																		
2015	33	133	35	32	18	0	7	10	10	-	0	1,572	-	-	-	-	-	1,850
2020	76	239	103	68	74	2	33	24	23	-	2	2,102	-	-	-	-	-	2,748
2025	129	324	213	111	187	6	85	43	40	-	4	2,900	-	-	-	-	-	4,042
2030	204	396	374	164	375	14	171	72	63	-	6	3,577	-	-	-	-	-	5,416
Non-food Retail																		
2015	239	567	31	95	69	2	20	15	35	-	-	4	-	-	-	-	-	1,077
2020	560	1,013	92	208	294	10	94	37	69	-	-	17	-	-	-	-	-	2,393
2025	952	1,351	193	354	741	30	242	69	114	-	-	29	-	-	-	-	-	4,076
2030	1,511	1,611	344	552	1,493	67	493	119	173	-	-	44	-	-	-	-	-	6,407
Hotel / Motel																		
2015	42	315	-	31	67	1	14	68	16	1	-	5	-	-	-	-	-	560
2020	98	566	-	67	276	8	61	184	37	3	-	23	-	-	-	-	-	1,322
2025	167	764	-	111	675	22	152	398	64	5	-	39	-	-	-	-	-	2,397
2030	266	929	-	167	1,325	47	298	770	99	10	-	58	-	-	-	-	-	3,969
Healthcare																		
2015	53	93	-	21	22	0	17	7	91	1	0	1	-	-	-	-	-	308
2020	128	166	-	44	100	2	79	20	107	3	2	4	-	-	-	-	-	655
2025	226	221	-	72	263	6	202	43	126	6	3	6	-	-	-	-	-	1,175
2030	367	262	-	108	550	14	405	82	149	11	5	10	-	-	-	-	-	1,962

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Education																		
2015	177	307	18	45	119	0	22	98	383	3	2	5	-	-	-	-	-	1,179
2020	423	547	55	99	481	2	98	226	457	8	9	19	-	-	-	-	-	2,424
2025	740	728	117	164	1,230	7	249	406	545	17	15	31	-	-	-	-	-	4,249
2030	1,206	864	211	248	2,547	16	498	665	651	31	23	45	-	-	-	-	-	7,004
Recreation Centres																		
2015	25	56	60	63	8	0	10	14	2	-	-	144	-	-	-	-	-	382
2020	58	100	179	135	35	0	26	36	4	-	-	311	-	-	-	-	-	883
2025	97	132	366	222	95	0	50	71	6	-	-	523	-	-	-	-	-	1,564
2030	150	156	637	328	209	1	86	127	10	-	-	808	-	-	-	-	-	2,512
Restaurant																		
2015	16	339	-	60	53	1	17	35	6	-	3	337	-	-	-	-	-	867
2020	44	609	-	129	167	4	49	95	13	-	15	472	-	-	-	-	-	1,598
2025	85	820	-	212	361	10	104	208	24	-	26	683	-	-	-	-	-	2,534
2030	149	994	-	317	654	22	195	409	37	-	40	909	-	-	-	-	-	3,726
Warehouse / Wholesale																		
2015	42	148	197	72	71	0	23	13	81	2	-	0	-	-	-	-	-	650
2020	99	267	589	156	241	0	62	32	127	5	-	1	-	-	-	-	-	1,581
2025	170	361	1,234	259	603	1	124	66	187	11	-	2	-	-	-	-	-	3,016
2030	270	440	2,201	390	1,272	2	218	123	263	19	-	3	-	-	-	-	-	5,201
Other General Service																		
2015	288	530	20	94	160	7	60	30	441	-	1	3	-	-	-	-	-	1,634
2020	689	963	61	207	519	14	170	71	578	-	4	15	-	-	-	-	-	3,291
2025	1,199	1,313	129	350	1,178	21	361	129	749	-	7	25	-	-	-	-	-	5,461
2030	1,934	1,611	231	540	2,261	27	670	215	960	-	11	38	-	-	-	-	-	8,498

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Non-Buildings																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Street lighting																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145	-	145
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	592	-	592
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,387	-	1,387
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,620	-	2,620
Parking Lot Plug																		
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	10
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	25
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	47	47
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	82	82
Grand Total																		
2015	1,219	2,922	362	581	800	20	229	332	1,770	13	7	2,072	-	-	-	145	10	10,481
2020	2,892	5,251	1,080	1,261	2,957	78	848	823	2,361	36	32	2,971	-	-	-	592	25	21,207
2025	5,000	7,067	2,253	2,099	7,102	204	2,016	1,612	3,105	74	56	4,251	-	-	-	1,387	47	36,271
2030	8,044	8,542	3,999	3,179	14,012	433	3,926	2,876	4,035	132	84	5,508	-	-	-	2,620	82	57,472

Exhibit H-2 Total Lower Achievable Potential Electricity Savings by End Use, Sub Sector and Milestone Year (MWh/yr.) – Hydro Grid

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Office																		
2015	162	422	-	49	91	4	21	22	615	3	-	0	-	-	-	-	-	1,390
2020	399	747	-	102	383	22	101	53	765	9	-	2	-	-	-	-	-	2,583
2025	727	988	-	165	975	68	267	101	985	18	-	4	-	-	-	-	-	4,299
2030	1,234	1,165	-	246	1,993	157	556	176	1,299	33	-	9	-	-	-	-	-	6,868
Food Retail																		-
2015	18	129	19	23	8	0	4	5	1	-	0	1,017	-	-	-	-	-	1,224
2020	42	229	57	47	40	1	19	13	6	-	1	2,386	-	-	-	-	-	2,842
2025	76	304	123	75	111	4	51	25	15	-	1	3,157	-	-	-	-	-	3,943
2030	126	361	226	109	240	10	108	44	32	-	2	3,681	-	-	-	-	-	4,938
Non-food Retail																		-
2015	128	552	16	68	33	1	11	8	14	-	-	0	-	-	-	-	-	831
2020	310	973	51	145	160	7	54	20	27	-	-	4	-	-	-	-	-	1,751
2025	555	1,274	113	243	443	20	149	40	52	-	-	11	-	-	-	-	-	2,900
2030	928	1,479	210	378	959	47	317	74	95	-	-	22	-	-	-	-	-	4,510
Hotel / Motel																		-
2015	22	306	-	22	32	1	7	34	2	1	-	1	-	-	-	-	-	428
2020	54	542	-	47	147	5	34	105	9	1	-	6	-	-	-	-	-	950
2025	98	717	-	75	393	14	90	252	24	3	-	14	-	-	-	-	-	1,680
2030	164	845	-	112	830	32	184	522	49	5	-	29	-	-	-	-	-	2,773
Healthcare																		-
2015	28	91	-	15	11	0	9	4	90	1	0	0	-	-	-	-	-	249
2020	71	160	-	31	58	1	45	11	105	2	1	1	-	-	-	-	-	486
2025	132	209	-	49	166	4	122	27	123	3	1	2	-	-	-	-	-	839
2030	227	241	-	72	369	10	256	55	145	6	1	5	-	-	-	-	-	1,386

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Education																		-
2015	95	299	10	32	55	0	12	50	380	2	1	1	-	-	-	-	-	935
2020	236	526	31	68	267	2	56	120	450	4	2	5	-	-	-	-	-	1,767
2025	437	687	69	110	760	5	149	227	536	9	4	12	-	-	-	-	-	3,005
2030	751	794	131	166	1,689	11	313	391	639	16	6	23	-	-	-	-	-	4,931
Recreation Centres																		-
2015	13	54	32	45	5	0	5	7	0	-	-	47	-	-	-	-	-	209
2020	32	96	98	93	22	0	14	20	1	-	-	113	-	-	-	-	-	488
2025	55	124	209	150	65	0	28	43	3	-	-	215	-	-	-	-	-	892
2030	90	143	379	219	149	0	51	83	5	-	-	375	-	-	-	-	-	1,495
Restaurant																		-
2015	9	330	-	44	25	1	9	18	1	-	1	216	-	-	-	-	-	654
2020	25	584	-	90	85	3	28	56	4	-	4	517	-	-	-	-	-	1,396
2025	51	770	-	145	199	7	63	135	9	-	8	711	-	-	-	-	-	2,096
2030	94	906	-	214	387	16	124	281	19	-	12	885	-	-	-	-	-	2,938
Warehouse / Wholesale																		-
2015	23	144	105	52	33	0	12	7	57	1	-	0	-	-	-	-	-	433
2020	55	256	328	108	136	0	33	18	79	3	-	0	-	-	-	-	-	1,017
2025	99	339	720	175	386	1	71	41	116	6	-	1	-	-	-	-	-	1,954
2030	167	400	1,344	262	875	1	133	80	175	10	-	2	-	-	-	-	-	3,449
Other General Service																		-
2015	153	513	11	68	79	4	31	15	389	-	0	0	-	-	-	-	-	1,265
2020	380	913	34	144	281	7	95	38	476	-	1	4	-	-	-	-	-	2,373
2025	694	1,214	75	238	690	10	217	73	601	-	2	10	-	-	-	-	-	3,824
2030	1,176	1,437	139	364	1,414	14	426	128	777	-	3	19	-	-	-	-	-	5,897

Sub Sector / Milestone Year	General Lighting	Architectural Lighting	High-bay Lighting	Outdoor Lighting	Space Heating	Space Cooling	HVAC Fans and Pumps	Water Heating	Computer Equipment	Other Plug Loads	Cooking Equipment	Refrigeration	Elevators	Miscellaneous	Non Buildings	Street Lighting	Block Heater	Grand Total
Non-Buildings																		-
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Street lighting																		-
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	145	-	145
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	592	-	592
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,387	-	1,387
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,620	-	2,620
Parking Lot Plug																		-
2015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5
2020	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	13
2025	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	25
2030	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43	43
Grand Total																		-
2015	651	2,841	193	417	372	11	121	170	1,551	7	2	1,282	-	-	-	145	5	7,768
2020	1,604	5,025	600	874	1,579	48	480	454	1,923	19	9	3,038	-	-	-	592	13	16,258
2025	2,924	6,626	1,308	1,426	4,188	135	1,207	962	2,464	39	16	4,137	-	-	-	1,387	25	26,843
2030	4,957	7,772	2,430	2,143	8,905	298	2,467	1,835	3,236	70	24	5,048	-	-	-	2,620	43	41,849